Washington University in St. Louis

SCHOOL OF LAW

Interdisciplinary Environmental Clinic

September 3, 2015

Ms. Wendy Vit
Chief, Air Quality Planning Section
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P.O. Box 176
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Via email to apcpsip@dnr.mo.gov

Re: 2010 1-Hour Sulfur Dioxide Standard, Proposed Options for Area Boundary Recommendations, July 2016 Designations

Dear Ms. Vit:

On behalf of the Sierra Club, we submit the following comments on the 2010 1-Hour Sulfur Dioxide Standard, Proposed Options for Area Boundary Recommendations, July 2016 Designations.[1] We strongly urge the Department of Natural Resources ("DNR") to propose and the Air Conservation Commission to adopt and submit to the Environmental Protection Agency ("EPA") a recommended designation of nonattainment based on modeling for the Ameren Labadie Energy Center in Franklin County, Missouri.

The Labadie plant is far-and-away the largest source of SO_2 pollution in the state. It is calculated to be responsible for more premature deaths than any other coal plant in the nation without scrubbers.[2] While Ameren has installed scrubbers – which are long-proven, highly-effective SO_2 controls – on its Sioux plant, it appears to be spending considerable money on consultants and poorly-sited monitors to try to avoid installing scrubbers at Labadie.

Because three years of source-oriented monitoring data are not available for the Labadie plant, the designation must be based on modeling in order to meet the July 2016 deadline in the March 2, 2015 federal Consent Decree for the next round of sulfur dioxide ("SO_2") designations.[3] DNR's modeling demonstrates that the area surrounding the Labadie plant is not attaining the 2010 1-hour SO_2 national ambient air quality standard ("NAAQS") based on the most recent three years of the Labadie plant's actual emissions.

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[1] DNR, 2010 1-Hour Sulfur Dioxide Standard, Proposed Options for Area Boundary Recommendations, July 2016 Designations, July 24, 2015("Proposed 2016 Designation Options"), available at http://dnr.mo.gov/env/apcp/docs/2010-so2-options-for-july-2016-desig-aug-27-2015-pub-hrg.pdf.

[2] Environmental Integrity Project, *Net Loss: Comparing the Cost of Pollution vs. the Value of Electricity from 51 Coal-Fired Plants* (June 2012) at i-ii.

[3] *Sierra Club v. McCarthy*, No. 3:13-cv-3953-SI, Consent Decree filed March 2, 2015, available at http://www.epa.gov/so2designations/pdfs/201503FinalCourtOrder.pdf.

DNR's alternative option of an unclassifiable designation is not appropriate because unclassifiable only applies when there is insufficient data to support a nonattainment or attainment decision, and in this case DNR's modeling provides ample data to support a nonattainment designation. Ameren's suggestion that the area be designated attainment is directly refuted by DNR's modeling. Ameren's consultant made numerous questionable changes to DNR's modeling approach, without providing adequate justification or obtaining the necessary approval from EPA, for the apparent purpose of obtaining an attainment result. Ameren's modeling should be disregarded.

I. The Area Around The Labadie Energy Center Must Be Designated Nonattainment.

When the U.S. Environmental Protection Agency ("EPA") established the 1-hour SO_2 NAAQS in 2010, it emphasized the value of modeling in making area designations.

> [I]n areas without currently operating monitors but with sources that might have the potential to cause or contribute to violations of the NAAQS, we anticipate that the identification of NAAQS violations and compliance with the 1-hour SO2 NAAQS would primarily be done through refined, source-oriented air quality dispersion modeling analyses …
>
> Compared to other NAAQS pollutants, we would not consider ambient air quality monitoring alone to be the most appropriate means of determining whether all areas are attaining a short-term SO_2 NAAQS. Due to the generally localized impacts of SO_2, we have not historically considered monitoring alone to be an adequate, nor the most appropriate, tool to identify all maximum concentrations of SO_2.[4]

While EPA allows the use of modeling or monitoring to support a designation, a monitoring approach is only valid when it is based on three years of quality-assured data from appropriately-sited monitors.[5] Because the monitors at the Labadie plant[6] did not begin operating until April 2015, and the Consent Decree requires EPA to make an SO_2 designation for the Labadie plant by July 2, 2016, the Labadie designation must be based on modeling, not monitoring. EPA recognized this in Guidance issued shortly after the Consent Decree became final:

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[4] EPA, Primary National Ambient Air Quality Standard for Sulfur Dioxide, Final Rule, 75 Fed. Reg. 35520, 35551 (June 22, 2010).

[5] EPA, Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide (SO_2) Primary National Ambient Air Quality Standard (NAAQS), Final Rule, 80 Fed. Reg. 51052 (Aug. 21, 2015); EPA, Updated Guidance for Area Designations for the 2010 Primary Sulfur Dioxide National Ambient Air Quality Standard (Mar. 20, 2015) ("Updated SO_2 Designations Guidance"), available at http://www.epa.gov/airquality/sulfurdioxide/pdfs/20150320SO2designations.pdf.

[6] The SO_2 monitors that Ameren recently constructed near the Labadie plant are not sited in areas of expected peak SO_2 concentrations and their locations were not approved by EPA. Therefore, the data they are generating should not in any event be relied upon for regulatory decisions. See comments previously submitted to DNR on behalf of the Sierra Club regarding the Ameren's "Labadie Sulfur Reduction Quality Assurance Project Plan," (Apr. 1, 2015), DNR's 2015 Monitoring Network Plan (July 20, 2015), and supplemental comments regarding the 2015 Monitoring Network Plan (Aug. 11, 2015). Copies of those letters are attached hereto as Exhibits 1, 2, and 3.

> We recognize that the timeline for designations by July 2, 2016, does not provide for establishment and use of data from new ambient monitors. Therefore, **we anticipate that in many areas the most reliable information for informing these designations will be source modeling**. The EPA has issued guidance on the use of source modeling for this purpose in the SO_2 NAAQS Designations Modeling Technical Assistance Document (Modeling TAD).[7]

Pursuant to EPA Guidance,[8] DNR performed dispersion modeling that compels a nonattainment designation. According to DNR:

> The area containing the Ameren Labadie Energy Center models violations of the 2010 1-hour SO_2 standard using actual emissions.[9]

Using 9 ppb as the regional background concentration, DNR's "maximum modeled concentration for the area was 234.5 $\mu g/m^3$ or 89 ppb, which is not in compliance with the 1-hour SO_2 standard of 75 ppb."[10] DNR also considered using the Mott Street monitor in Herculaneum for "a more conservative background concentration" of 18 ppb, which "would yield a maximum modeled concentration of 98 ppb."[11]

Sierra Club retained a modeling consultant to conduct independent modeling regarding the Labadie plant. Modeling performed by Wingra Engineering confirms that the area around the Labadie plant violates the 1-hour SO_2 NAAQS.[12]

Pursuant to section 107(d)(1) of the Clean Air Act and EPA guidance applicable specifically to the 1-hour SO_2 NAAQS, the area around the Labadie plant must be designated nonattainment.

II. The Unclassifiable Option in DNR's Proposal is Inappropriate.

The unclassifiable designation applies only "[i]n the absence of information clearly demonstrating a designation of 'attainment' or 'nonattainment.'"[13] Because DNR's modeling

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[7] Updated SO_2 Designations Guidance at 3 (emphasis supplied).
[8] Updated SO_2 Designations Guidance and EPA, SO_2 NAAQS Designations Modeling Technical Assistance Document ("Modeling TAD"), available at http://www.epa.gov/airquality/sulfurdioxide/pdfs/SO2ModelingTAD.pdf.
[9] Proposed 2016 Designation Options at 26.
[10] *Id.* at 27.
[11] *Id.*
[12] The Wingra Engineering modeling report is submitted herewith as Exhibit 4. Wingra Engineering determined that meteorological data from the Spirit of St. Louis airport was more representative of site conditions than the Jefferson City airport data used by DNR in its modeling. Although the NAAQS exceedances modeled by Wingra Engineering are almost identical to those modeled by DNR, the area boundaries based on Wingra's modeling would differ in part from those proposed by DNR. The geographic scope of the appropriate nonattainment area boundary is discussed below.
[13] Updated SO_2 Designations Guidance at 5.

demonstrated NAAQS violations near the Labadie plant compelling a nonattainment designation, the unclassifiable option in DNR's proposal is inapplicable and inappropriate.

DNR's unclassifiable option relies on (1) three months of not quality-assured data from monitors recently constructed by Ameren near the Labadie plant and (2) monitoring data from long-inactive monitors that documented high concentrations of SO_2. DNR's suggestion that the monitoring data casts doubt on the conclusions of its modeling falls far short of the mark.

First, the Labadie monitoring data cannot and do not undermine the nonattainment designation compelled by DNR's modeling. *Three months* of preliminary data from the new Labadie monitors are meaningless; *three years* of quality-assured monitoring data are required in order to determine whether an area complies with the 1-hour SO_2 NAAQS.[14] Accordingly, EPA Guidance recognizes that modeling, not monitoring, will be the principal basis for making designations for areas subject to the July 2016 deadline.[15]

In addition, the fact that Ameren's Labadie monitors have not recorded any SO_2 concentrations above the NAAQS during their first three months of operation should come as no surprise to DNR. Using the MAXDAILY output option, DNR's modeling – which documents nonattainment for a three-year period – predicts no NAAQS exceedances during the three-month time period of the Labadie monitoring data in any of the modeled years at Ameren's Northwest monitoring site, and no NAAQS exceedances in two of the three modeled years (2013 and 2014) at Ameren's Valley monitoring site.

Moreover, the data from Ameren's Labadie monitors should not be relied upon for NAAQS compliance purposes because the monitors are not sited in areas of expected peak concentrations. The modeling conducted by DNR for the Proposed 2016 Designation Options (after Ameren sited its Labadie monitors) makes clear that the Valley monitor is not sited in an area of expected peak concentrations. Furthermore, preliminary meteorological data collected by Ameren at the Valley monitoring site suggests that the meteorological data used in DNR's modeling[16] is not as representative of site conditions as meteorological data collected at the Spirit of St. Louis Airport. Modeling conducted with meteorological data from the Spirit of St. Louis Airport demonstrates that neither of Ameren's monitors is located in an area of expected peak concentrations.[17]

Second, monitoring data from the long-inactive Augusta and Augusta Quarry SO_2 monitors similarly fail to undermine the nonattainment designation required by DNR's modeling. There is no indication that either of those monitors was sited in areas of expected peak concentrations caused by the Labadie plant's emissions. To the contrary, DNR's modeling indicates that they were not sited in areas of expected peak concentrations associated with Labadie's emissions. This is shown in Figure 1, below.

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[14] The form of the 1-hour SO_2 NAAQS is the three-year average of the 99th percentile of 1-hour daily maximum concentrations.

[15] Updated SO2 Designations Guidance at 3.

[16] DNR used meteorological data collected at Jefferson City Memorial Airport in its modeling.

[17] See Exhibits 1, 2, and 3 submitted herewith.

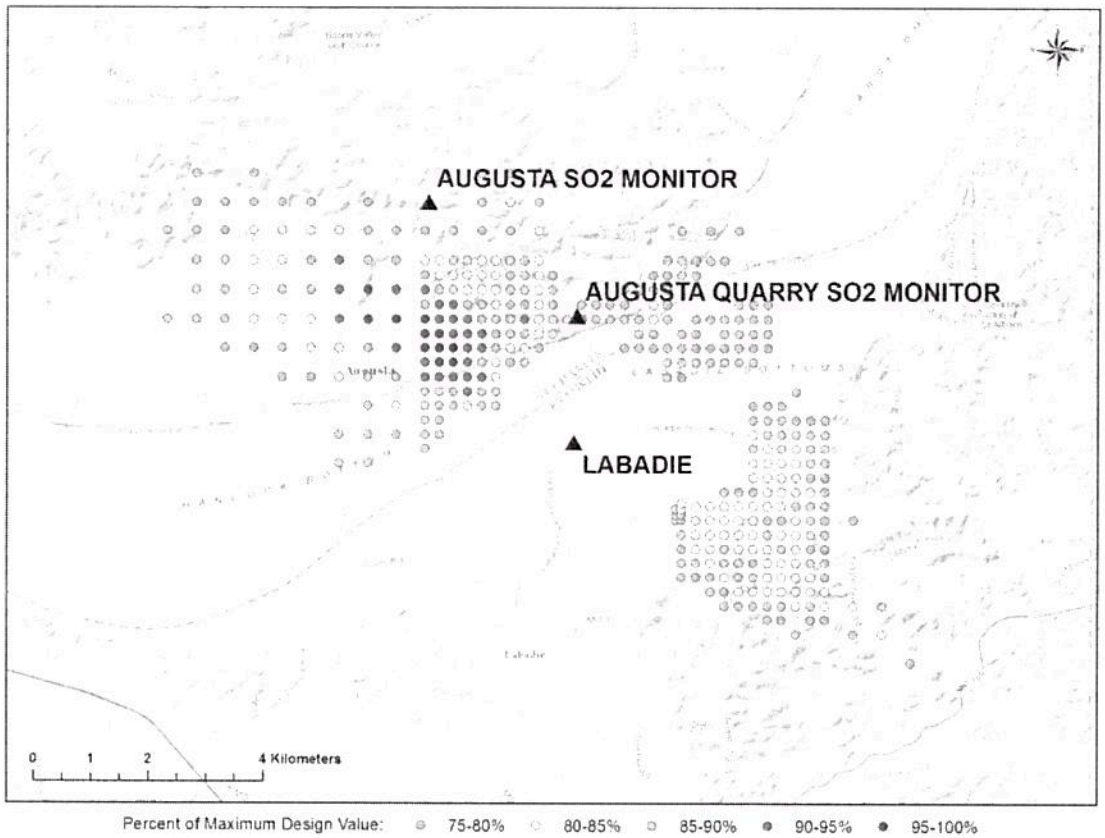

Figure 1. Augusta SO_2 monitors in relation to DNR's modeled peak concentration areas.

Furthermore, the data from the Augusta monitors reveal high 1-hour SO_2 concentrations, with consistent violations of the NAAQS. The Augusta monitor operated from July 1, 1987 until December 19, 1994. The design values for every three-year period during the monitor's operation were well above the 1-hour SO2 NAAQS – ranging from 259 ppb for 1987-1989 to 114 ppb for 1992-1994.[18] The Augusta Quarry site operated for three full years (1995-1997) and portions of two additional years (1994 and 1998). The design value for the only complete three-year period was 78 ppb, exceeding the 1-hour SO_2 NAAQS. The fourth-highest one-hour readings during two of the three complete data years were well above the 1-hour SO_2 NAAQS (86 ppb in 1995 and 80 ppb in 1997).[19]

In sum, there is no legitimate reason for an unclassifiable designation for the area around the Labadie plant.

[18] Proposed 2016 Designation Options, Appendix F, at F-3.
[19] *Id.* at F-2.

III. Ameren's Modeling Purporting To Support An Attainment Designation Actually Shows NAAQS Violations Near The Labadie Plant When Appropriate Inputs Are Used.

Ameren provided DNR with its own modeling using the latest release of AERMOD (v15181) that purports to support an attainment designation for the Labadie plant. We obtained a copy of Ameren's modeling data just before DNR's September 3 comment deadline, so our ability to comment on it in this letter is limited. Based on a cursory review and Ameren's consultant's description of it in his public hearing testimony at the August 27 Missouri Air Conservation Commission meeting, we believe that Ameren's modeling would actually show NAAQS violations near the Labadie plant if appropriate inputs were used. Therefore, it actually supports a nonattainment designation as DNR's option #1 proposes.

There are three key differences between Ameren's new modeling and DNR's. First, Ameren merged the emissions from Units 3 and 4 in a common stack, whereas DNR modeled the emissions from Units 3 and 4 separately. Second, Ameren used a pair of non-default beta options, ADJ_U* in AERMET and LowWind3 in AERMOD, which were added to the latest model release to address concerns regarding model performance under low wind speed conditions. Finally, Ameren used a background concentration based on a monitor in Nilwood, Illinois, that varies by season and hour-of-day instead of the uniform 9 ppb background concentration used by DNR, based on the monitor in East St. Louis.

As justification for merging the emissions from Units 3 and 4 in a common stack, Ameren cites EPA Model Clearinghouse Report 91-II-01. Model Clearinghouse Reports provide EPA's interpretation of modeling guidance as it applies to specific applications of air dispersion models. While often relevant to other, similar applications, Model Clearinghouse Reports do not serve as guidance of general applicability. EPA issues general guidance related to the Guideline on Air Quality Models ("Guideline") and technical aspects of dispersion models in formal "Clarification Memos." Furthermore, Model Clearinghouse Report 91-II-01 relates to the modeling of an unspecified stationary source using an unspecified model different from AERMOD.[20] Its relevance, if any, to the application of AERMOD to evaluate NAAQS compliance around the Labadie plant is speculative at best.[21] Therefore, it should not be relied upon as justification for merging the emissions from Units 3 and 4 in a common stack.

Regarding Ameren's use of non-default beta options in the latest release of AERMOD, EPA has acknowledged issues with the performance of AERMOD under low wind conditions and has proposed that these options be included as regulatory default options in a 2016 version of

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[20] Development of AERMOD did not commence until 1991 and it was not adopted as EPA's preferred model for regulatory dispersion modeling until 2005. Therefore, it is inconceivable that AERMOD was used in the permit application that was the subject of Model Clearinghouse Report 91-II-01.

[21] The configuration of the stacks at the source discussed in the report was different from the configuration of the stacks at Labadie, and the report concluded that they could be merged based on an unverified assumption about the separation distance between the stacks relative to the lesser dimension of nearby structure(s), and only if the flow rates and temperatures were always the same for all three stacks. It is not known whether these conditions are met at Labadie.

AERMOD associated with a potential future final rule revising the Guideline.[22] However, they are only proposed options at this time, and EPA may or may not ultimately include either or both as regulatory defaults in the next version of AERMOD.[23] Furthermore, since they are non-default beta options in the latest release of AERMOD, their use presently requires an alternate model demonstration per Section 3.2.2 of the Guideline, which must be approved by the EPA Regional Administrator. Ameren's submission of its new modeling to DNR did not include an alternate model demonstration.

Apart from these questionable changes, the fatal flaw in Ameren's new modeling is the use of a cherry-picked "background" concentration below that used by DNR.

Ameren's background concentration is based on a monitor in Nilwood, Illinois, and varies by season and hour-of-day. This and other temporally-varying background options have been available in AERMOD since v11059. During most hours and seasons, Ameren's background concentration is significantly lower than DNR's uniform 9 ppb background concentration, which is the design value for the nearest ambient monitor (East St. Louis) based on readings for the sector with the least source influence.[24] (DNR also noted that it might be appropriate to use a more conservative background concentration of 18 ppb based on the fourth-high value of the Mott Street monitor in 2014.[25]) EPA guidance currently recommends using the overall highest hourly background SO_2 concentration from a representative monitor as a "first tier" background concentration,[26] which is a more conservative approach than DNR's. EPA's proposed revised Guideline regulations recommend using the design value as a uniform monitored background contribution across the project area, as DNR did. Ameren's use of temporally-varying background concentration does not comport with either EPA's current guidance or its proposed revised Guideline regulations.

In addition, it is noteworthy that the design value for the Nilwood monitor for the most recent three year period (2012-2014) was 9.3 ppb, slightly higher than the 9 ppb background concentration DNR used in its modeling. Previous design values for the Nilwood monitor were 8 ppb (2011-2013), 10 ppb (2010-2012), and 13 ppb (2009-2011).

The peak SO_2 concentration predicted by Ameren's new model is 73.7 ppb (approximately 193.3 ug/m^3) at a point roughly 3 kilometers northwest of the plant. This is slightly below the NAAQS, but only because Ameren used a less conservative background concentration than that used by DNR. **Using DNR's background concentration, the peak SO_2 concentration predicted by Ameren's new model exceeds the NAAQS.**

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[22] EPA published a notice of proposed rulemaking proposing enhancements to the AERMOD dispersion modeling system and revisions to the Guideline on July 29, 2015. 80 Fed. Reg. 45399, available at http://www.gpo.gov/fdsys/pkg/FR-2015-07-29/pdf/2015-18075.pdf.

[23] George Bridgers, personal communication, September 1, 2015.

[24] Proposed 2016 Designation Options, Appendix A, at A-12.

25 Proposed 2016 Designation Options at 27.

[26] EPA, Applicability of Appendix W Modeling Guidance for the 1-hour $S0_2$ National Ambient Air Quality Standard, Aug. 23, 2010, at 3.

Ameren's new modeling appears to be "results-oriented" in that its inputs were apparently tailored to yield a desired result –the appearance of no NAAQS violations near the Labadie plant – and not to accurately determine the attainment status of the area. Most egregious is the substitution of a more favorable background concentration, in a form not sanctioned by EPA guidance or regulations, instead of the background concentration used by DNR. Ameren's request for an attainment designation based on its manipulated modeling should be rejected.

IV. DNR's Proposed Nonattainment Boundaries Should Be Modified.

In addition to recommending a designation of nonattainment around the Labadie plant, DNR should modify the proposed boundaries of the nonattainment area. Per EPA guidance, the analytical starting point for determining SO_2 nonattainment areas is county boundaries.[27] Modeled NAAQS violations due to Labadie occur in both Franklin and St. Charles Counties, making these counties the starting point for the nonattainment area boundary. Partial county boundaries are appropriate in this instance, however, due to the fairly limited geographic scope of the modeled violations. For defining partial county boundaries, EPA recommends the use of well-defined jurisdictional lines such as township borders or other geopolitical boundaries, immovable landmarks, and readily identifiable physical features.[28] DNR's proposed boundary includes only portions of the two townships containing the modeled violations – Boles Township in Franklin County and Boone Township in St. Charles County – cutting off portions of both townships along transecting roadways.[29] This results in dividing up the communities of Gray Summit and Pacific in the south and New Melle in the north, creating the potentially confusing situation where some portions of each community are inside the nonattainment area and other portions are outside. To avoid this situation, we recommend modifying the proposed boundaries of the nonattainment area to include all of Boone and Boles Townships. These townships encompass just 20 percent of the total combined area of Franklin and St. Charles Counties, and therefore represent reasonable partial county boundaries for the nonattainment area.

Alternatively, DNR should consider modifying the proposed boundaries of the nonattainment area to encompass a larger portion of northeast Franklin County, which DNR's modeling suggests encompasses most if not all modeled violations when potentially more representative meteorological data from the Spirit of St. Louis Airport in Chesterfield is used.[30] With Spirit of St. Louis Airport meteorological data, the locus of modeled violations shifts to the south and southwest of the plant. A more appropriate nonattainment area boundary based on these modeled violations would encompass Boles Township, a small portion of Boone Township (south of

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[27] Updated SO_2 Designations Guidance at 5.

[28] *Id.* at 6.

[29] The northern portion of Boone Township is cut off by Missouri Route D and Highway 94; the southern portion of Boles Township is cut off by Interstate 44.

[30] Preliminary meteorological data from Ameren's Valley monitoring site suggest that the winds at Labadie may be more similar to the winds at Spirit of St. Louis Airport ("KSUS") in Chesterfield than the winds at Jefferson City Memorial Airport ("KJEF") in Jefferson City, which in turn suggests that KSUS surface meteorological data may be more representative of the area and more appropriate for modeling Labadie's emissions than KJEF data. See supplemental comments previously submitted to DNR on behalf of the Sierra Club regarding DNR's 2015 Monitoring Network Plan, attached hereto as Exhibit 3.

Missouri Highway 94), and the area west of Boles Township bounded by Missouri Route 47 and the municipal boundaries of Washington and Union, Missouri. This is shown in Figure 2, below.

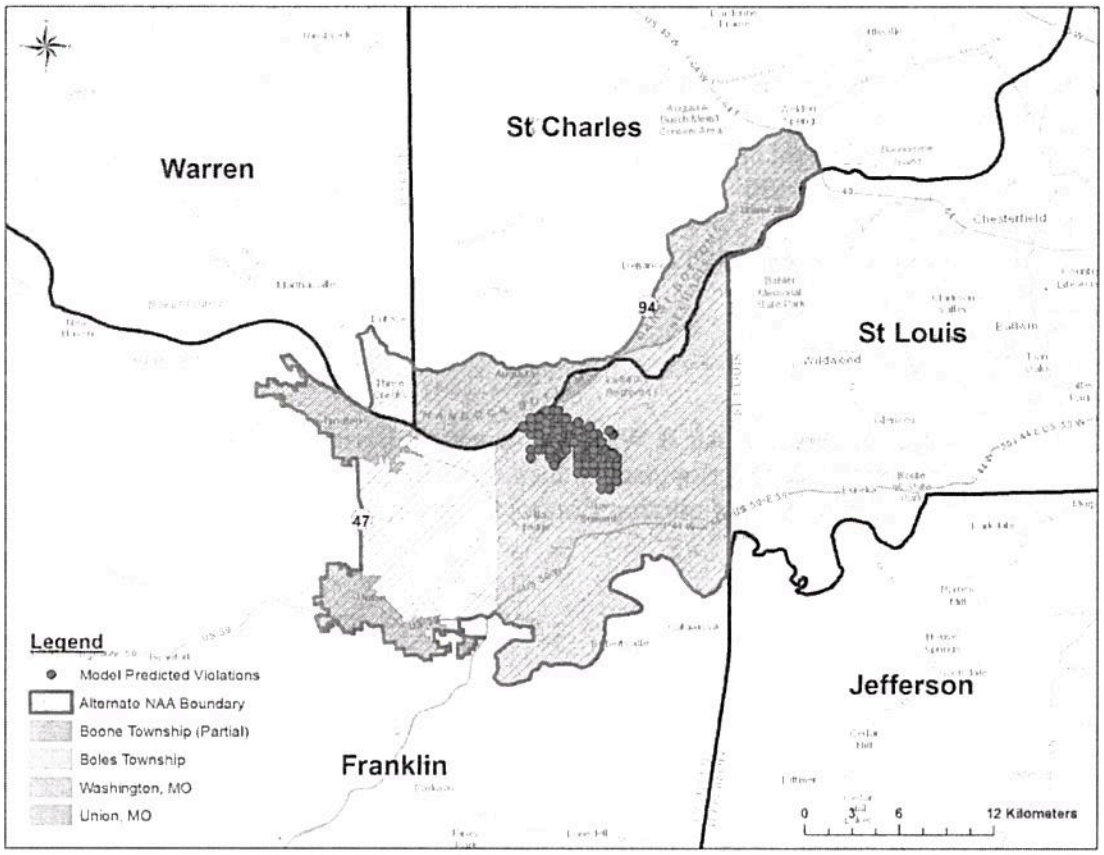

Figure 2. Alternative nonattainment area boundary based on Spirit of St. Louis Airport meteorological data.

Conclusion

We strongly urge the DNR to propose and the Air Conservation Commission to approve and submit to the EPA a recommended designation of nonattainment based on modeling for the Ameren Labadie Energy Center in Franklin County, Missouri. DNR's modeling demonstrates that the area surrounding the Labadie plant is not attaining the 2010 1-hour SO_2 national ambient air quality standard ("NAAQS") based on the most recent three years of actual emissions. This compels a nonattainment designation.

For the reasons set forth above, the unclassifiable designation option is inapplicable and inappropriate, and Ameren's suggestion for an attainment designation is fanciful.

Sincerely yours,

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April 13, 2015

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Re: Comments on Ameren Missouri's Labadie Sulfur Reduction Project Quality Assurance Project Plan

Dear Ms. Maliro:

On behalf of the Sierra Club, we submit the following comments on Ameren Missouri's Labadie Sulfur Reduction Project Quality Assurance Project Plan (QAPP). The QAPP describes the methodology Ameren used to determine the locations of two proposed ambient sulfur dioxide (SO_2) monitoring stations around its Labadie Energy Center in connection with the 1-hour SO_2 National Ambient Air Quality Standard (NAAQS). We believe the QAPP should be disapproved because the proposed monitoring stations are improperly sited; they are outside areas where peak 1-hour SO_2 concentrations are expected to occur based on the modeling described in the QAPP. Furthermore, the modeling described in the QAPP does not comport with EPA guidance on characterizing ambient air quality in areas around or impacted by significant SO_2 emission sources such as the Labadie Energy Center and therefore may have failed to correctly identify areas of expected ambient, ground-level SO_2 concentration maxima.

I. Based on the Modeling Described in the QAPP, the Proposed Monitoring Stations are Improperly Sited Outside Areas Where Peak 1-Hour SO_2 Concentrations are Expected to Occur

Appendix 10 of the QAPP describes the modeling performed to determine the locations of the proposed ambient SO_2 monitoring stations around the Labadie Energy Center. The modeling was used to determine locations where peak 1-hour SO_2 concentrations are expected to occur due to the plant's SO_2 emissions given that the primary objective of source-oriented monitoring is to identify peak SO_2 concentrations in ambient air that are attributable to an identified emission source or group of sources.[1] Figure 1 shows all receptors with modeled design values greater than or equal to 75 percent of the maximum modeled design value. Figure 2 shows the receptors with the top 200, 100, 25, and 10 modeled design values.

[1] U.S. EPA, SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, at 2.

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Exhibit1

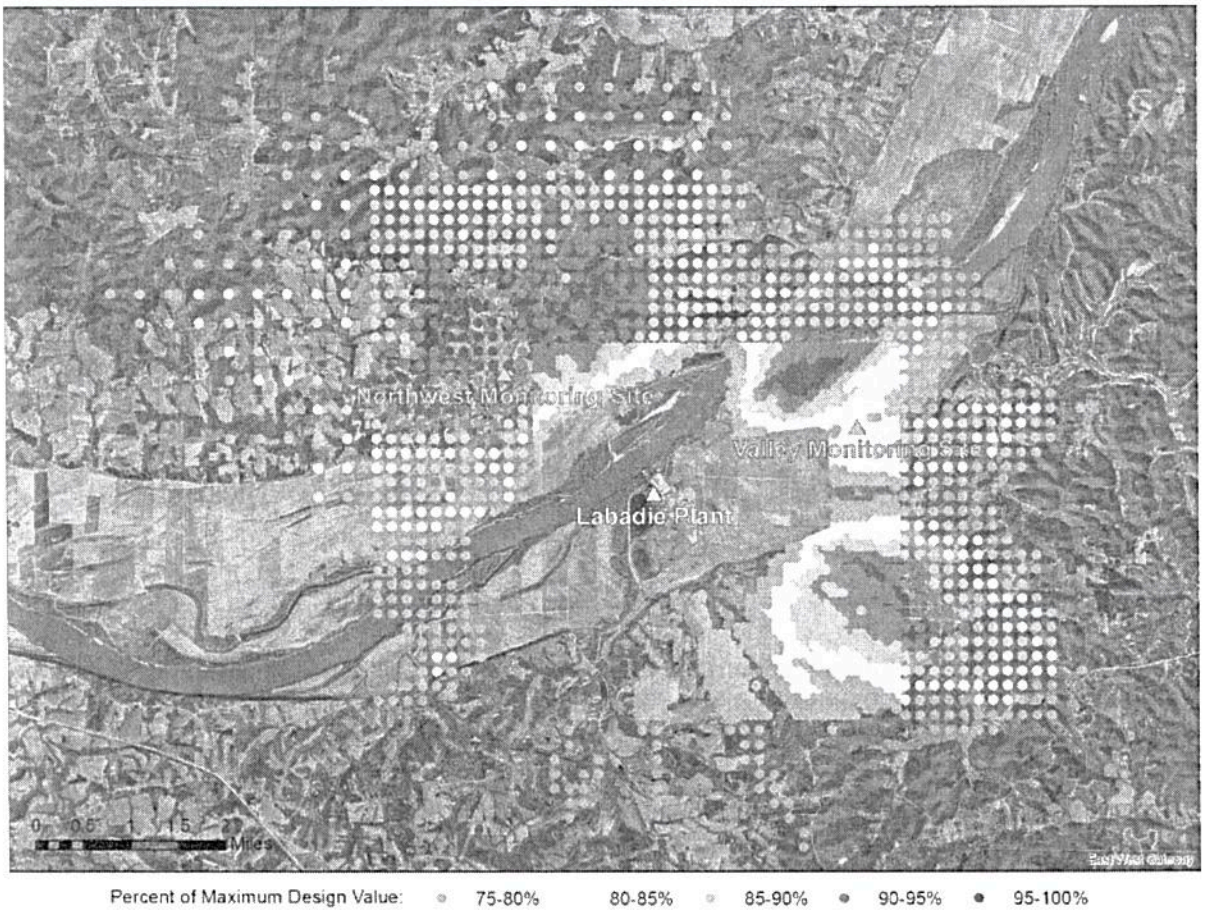

Figure 1. Receptors with modeled design values ≥75 percent of the maximum design value.

The modeling was also used to determine locations where elevated SO_2 concentrations are expected to occur most frequently given that the site selection process also needs to account for the frequency with which an area sees the daily maximum concentration.[2] Normally this involves counting the number of times each receptor sees the daily maximum 1-hour SO_2 concentration predicted by the model. However, the QAPP looks at it differently, counting instead the number of times the daily maximum 1-hour SO_2 concentration at each receptor exceeds 75 percent of the maximum modeled design value. Figure 3, which is reproduced from the QAPP,[3] shows the number of daily maximum 1-hour SO_2 concentrations at each receptor that exceed 75 percent of the maximum modeled design value.

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[2] *Id.* at A-6.

[3] See Appendix 10, Figure 6, "Counts of Max Daily 1-Hour Concentrations Greater Than 75% of the Max Modeled Design Value* (Years 2005-2009)."

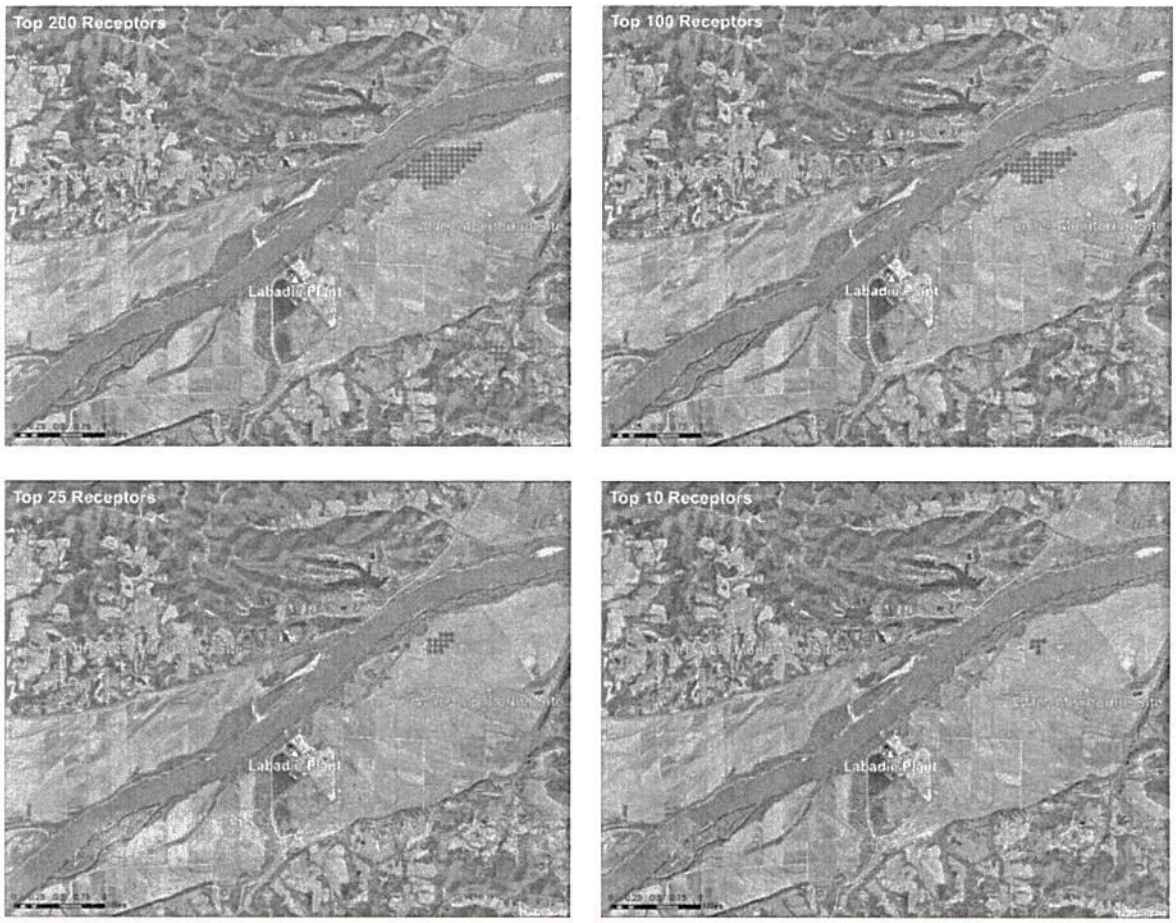
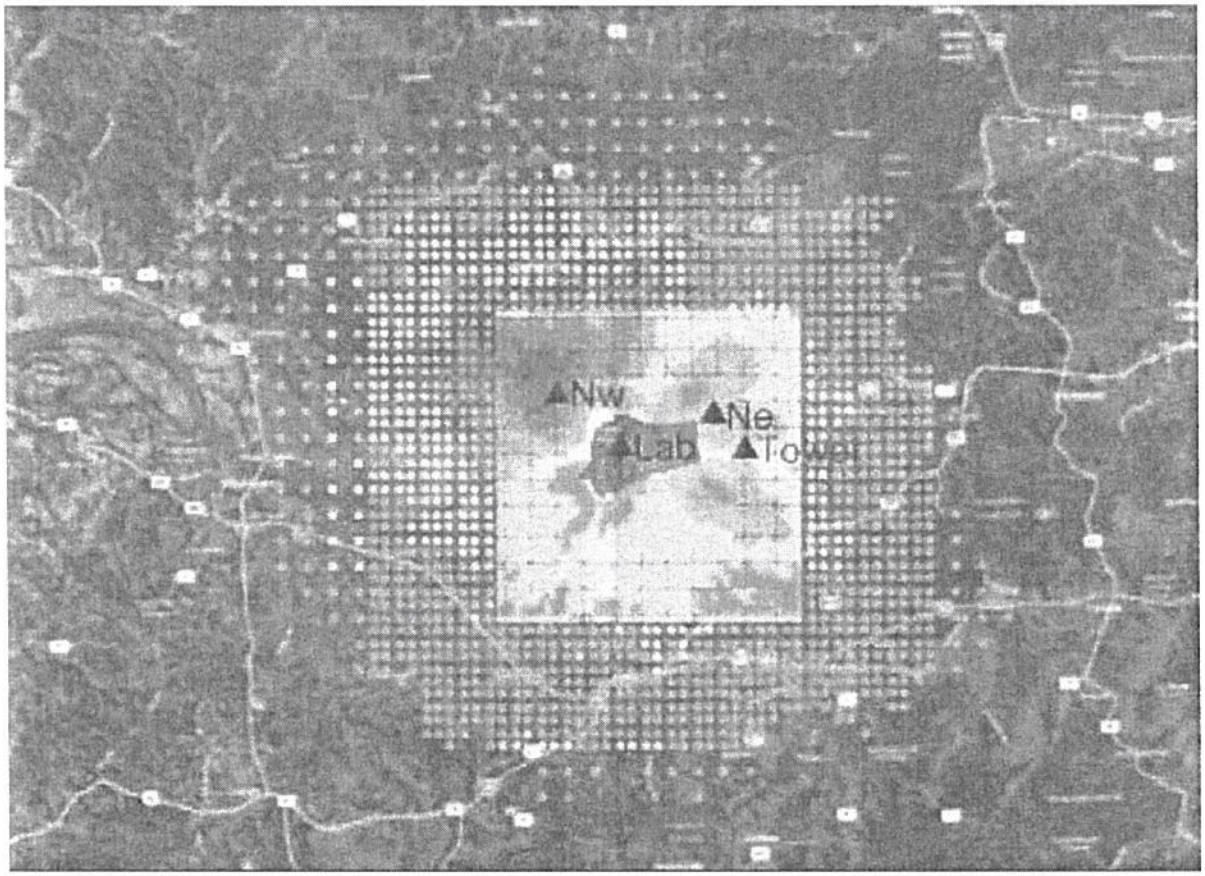


Figure 2. Receptors with the top 200, 100, 25, and 10 modeled design values.

Figures 1 and 2 reveal three distinct areas where modeled design values are in excess of 95 percent of the maximum modeled design value and where the majority of the top 200 receptors (and all of the top 100, 25 and 10 receptors) lie. These areas, located northwest, northeast, and southeast of the Labadie Energy Center, are where the modeling predicts peak 1-hour SO_2 concentrations are expected to occur. Furthermore, although a rigorous comparison is not possible without detailed receptor data, a simple visual comparison of Figures 1 and 3 indicates that the areas where peak 1-hour SO_2 concentrations are expected to occur (i.e., where modeled design values are in excess of 95 percent of the maximum modeled design value) overlap with the areas where daily maximum 1-hour SO_2 concentrations most frequently exceed 75 percent of the maximum modeled design value. Monitoring stations located in these areas would have the greatest chance of identifying peak SO_2 concentrations in ambient air, which is the primary objective of source-oriented monitoring and an absolute necessity when monitoring to assess compliance with the NAAQS.



Max Daily 1-Hour Concentrations >75% of the Maximum Modeled Design Value: 0-15 15-30 30-45 45-60 60-76

Figure 3. Number of maximum daily 1-hour SO_2 concentrations at each receptor that exceed 75 percent of the maximum modeled design value.

However, only one of Ameren's proposed monitoring sites, the northwest site, is located in one of the three peak concentration/high frequency areas predicted by the modeling (the one located northwest of the plant). No monitoring sites are proposed in the peak concentration/high frequency areas located northeast or southeast of the plant. Instead, Ameren's only other proposed monitoring site, the valley site, is located in an area where modeled design values are only about 80 percent of the maximum modeled design value and where daily maximum 1-hour SO_2 concentrations exceed 75 percent of the maximum modeled design value about half as often as they do in areas where this occurs with the greatest frequency. This makes the valley site an inappropriate site for a monitor to assess compliance with the NAAQS. Ameren's modeling predicts that ambient SO_2 concentrations will be as much as 25 percent higher in several areas around the plant than they will be at the valley site, meaning a monitoring station at the valley site could be in compliance with the NAAQS while significant violations were occurring nearby.

The QAPP states that a monitor could not be sited in the peak concentration/high frequency area northeast of the plant because it is an actively farmed area, physical access is almost impossible

without building additional infrastructure, and electric power is not available. These justifications do not stand up to the barest scrutiny. The entire Labadie Bottoms is an actively farmed area, accessible only by unimproved roads that severely limit vehicular access during wet weather conditions. As such, the proposed valley monitoring site is no more accessible than a site within the peak concentration/high frequency area northeast of the plant would be, and additional road infrastructure will likely be necessary for all-weather access regardless of where in the Labadie Bottoms the monitor is located.[4] Furthermore, electric power is not available anywhere within the Labadie Bottoms, including at the proposed valley monitoring site. Therefore, distribution infrastructure will have to be built to deliver power to any monitoring site in the Labadie Bottoms regardless of where it is located. The St. Albans Water and Sewer Authority/Franklin County PWSD #3 wastewater treatment facility, located approximately 1 kilometer east of the proposed valley monitoring site, appears to be the closest available source of electric power for monitoring sites in the Labadie Bottoms, and only a minimal amount of additional line would be necessary to deliver power to a monitor located in the peak concentration/high frequency area northeast of the plant compared to one located at the proposed valley monitoring site.

The QAPP's justification for not siting a monitor in the peak concentration/high frequency area southeast of the plant is equally flimsy. The QAPP states that the primary reason a monitor is not proposed in that area – despite the model predicting high design values and a high number of daily maximum 1-hour SO_2 concentrations in excess of 75 percent of the maximum modeled design value in that area – is because the elevated terrain there is similar to the terrain at the proposed northwest monitoring site and it was believed an additional elevated terrain site was not necessary. However, AERMOD accounts for terrain influences when calculating modeled design values, and variations in meteorological parameters, most notably wind direction, often result in peak 1-hour SO_2 concentrations occurring in different areas that have similar terrain (e.g., areas in different cardinal directions from the source). Therefore, the peak concentration/high frequency area southeast of the plant cannot be ignored simply because the terrain there is similar to the terrain in the peak concentration/high frequency area northwest of the plant. The purpose of an ambient SO_2 monitoring network is not to monitor different terrain types, but to monitor areas where peak 1-hour SO_2 concentrations are expected to occur regardless of the terrain in those areas. The QAPP also suggests that the high concentrations and frequencies predicted by the model southeast of plant are merely an artifact of the Jefferson City, MO Airport meteorology, which is influenced by the local orientation of the Missouri River valley at that met station. However, the wind roses provided in the QAPP for a number of met stations in eastern Missouri that are closer to Labadie, which the QAPP states better reflect the expected meteorology at Labadie, all show significant winds from the north or northwest, which is consistent with an area of peak concentration/high frequency southeast of the plant.

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[4] The peak concentration/high frequency area northeast of the plant is arguably more accessible than the proposed valley monitoring site given its proximity to the agricultural levee adjacent to the south bank of the Missouri River. The road on the crest of this levee is higher and most likely drier than other unimproved roads in the Labadie Bottoms, including those roads leading to the proposed valley monitoring site.

II. The Modeling Described in the QAPP Does Not Comport With EPA's Source-Oriented SO_2 Monitoring Guidance and Therefore May Not Correctly Identify Areas of Expected Ambient, Ground-Level SO_2 Concentration Maxima

EPA's SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document (TAD) provides guidance on how to "appropriately and sufficiently monitor ambient air in areas proximate to or impacted by an SO_2 emissions source to create ambient monitoring data for comparison to the SO_2 NAAQS" and presents "recommended steps to aid in identifying source-oriented SO_2 monitor sites."[5] The modeling described in the QAPP fails to adhere to the TAD in one critical respect: it does not use hourly emission rates, which are readily available for Labadie's boilers from EPA's online Air Markets Program Data tool. Instead it uses constant emission rates, which the QAPP states were "selected to produce rational ambient levels to be used for establishing monitoring locations and does not reflect actual emissions." The consequence of using constant rather than hourly emission rates is that the effects of the interaction between hourly emissions and hourly variations in meteorological parameters is ignored completely, so that the predicted areas of peak concentration and/or high frequency are primarily a function of the meteorology used. For example, if peak hourly emissions coincide with times when strong winds blow from a direction other than the prevailing wind direction, a model that uses hourly emission rates might predict high concentrations in different areas than the same model would predict using constant emission rates. Therefore, using hourly emissions allows the areas where peak 1-hour SO_2 concentrations are expected to occur to be determined with greater confidence.

III. DNR Should Not Deprive The Public and EPA of an Opportunity to Participate in the Monitoring Site Selection Process.

While the area around the Labadie plant will necessarily be evaluated for nonattainment designation purposes based on modeling in order to meet the July 2016 deadline set by *Sierra Club et al. v. McCarthy*, Civil Action No. 3:13–cv–3953–SI (N.D. Cal., March 2, 2015), it is difficult to imagine why DNR and Ameren would agree to install monitoring sites near the Labadie plant unless they expect to consider using the results for future NAAQS compliance evaluations. Monitoring sites used for such purposes must be included in the state's monitoring network plan, which must be proposed by DNR after public notice and the opportunity for public comment, and submitted to EPA for its review and approval. 40 CFR § 58.10.

Contrary to these requirements, DNR has been working with Ameren to select the Labadie monitoring sites and allow Ameren to commence monitoring at these inappropriate locations without public notice and opportunity for public comment, and without submitting the plans to EPA for its review and approval. Documents obtained recently from DNR suggest that Ameren is already preparing to construct the monitoring sites identified in the Labadie QAPP. In addition, the Consent Agreement attached as Appendix J to the proposed Jefferson County State Implementation Plan requires Ameren to submit "final network site recommendations" to DNR regarding the Rush Island plant by May 1, 2015, with equipment to be installed and calibrated by

[5] U.S. EPA, SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, at 2.

December 31, 2015 – with no provisions for public comment or for EPA review and approval. Unlike Labadie, where Ameren has provided documentation to DNR as to its (flawed) basis for monitoring site selection, Ameren appears to be developing its "final network site recommendations" for Rush Island without the prior submission to DNR of modeling data to support the site selection.[6]

DNR should not approve monitoring locations for the Labadie or Rush Island plants without first providing public notice and opportunity for comment, and without submitting the proposed locations to EPA for its review and approval.

Conclusion

Based on the modeling described in the QAPP, Ameren's proposed valley monitoring site is improperly located in an area where peak 1-hour SO_2 concentrations are **not** expected to occur. Furthermore, Ameren has failed to propose monitoring sites in peak concentration/high frequency areas located northeast and southeast of the Labadie Energy Center, citing justifications that don't withstand the barest scrutiny, despite the facts that there are numerous private residences within the peak concentration/high frequency area southeast of the plant and the peak concentration/high frequency area northeast of the plant is situated between the nearby communities of St. Albans and Augusta Shores. Therefore, we urge DNR to disapprove the QAPP and require Ameren to make the following changes:

1) Relocate the proposed valley monitoring site to the peak concentration/high frequency area northeast of the plant; and
2) Add a third monitoring site in the peak concentration/high frequency area southeast of the plant.

We also urge DNR to require Ameren to rerun the air dispersion model described in the QAPP using hourly emission rates in order to determine whether the model correctly identified the areas of expected ambient, ground-level SO_2 concentration maxima around the plant and to require a wholesale reevaluation of potential monitoring sites if the model used for the QAPP failed to correctly identify such areas.

Finally, we urge DNR to provide public notice and opportunity for comment, and to submit the proposed monitoring locations to EPA for its review and approval, in accordance with 40 CFR Part 58.

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[6] On behalf of the Sierra Club, the Clinic has submitted Sunshine Law requests for documents related to possible SO_2 monitoring at Labadie and Rush Island. The most recent request to which DNR has responded (submitted on February 19, 2015, with responsive documents provided April 2, 2015), requested: "All documents regarding the possible installation of SO_2 monitors at the Labadie and/or Rush Island power plants, including but not limited to Quality Assurance Project Plans and all related documents, and all AERMOD input and output files used in any modeling analysis performed to determine the locations of any proposed SO_2 monitoring sites." As of DNR's latest response (April 2, 2015), it has not provided any documents discussing or attempting to justify the selection of possible modeling sites at the Rush Island plant.

Respectfully submitted,

Maxine I. Lipeles

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On behalf of the Sierra Club

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July 20, 2015

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Re: 2015 Monitoring Network Plan

Dear Mr. Hall:

On behalf of the Sierra Club, we urge the Missouri Department of Natural Resources ("DNR") to revise the proposed 2015 Monitoring Network Plan[1] in order to satisfy the requirements of the Clean Air Act. In particular, DNR should refrain from proposing new sulfur dioxide ("SO_2") monitoring sites near Ameren's Labadie power plant until EPA completes an area designation for the plant. Monitors near Labadie should be sited based on the modeling that is used to determine the nonattainment area boundary, which will identify areas of expected peak ambient SO_2 concentrations around the plant based on current EPA guidance. Should DNR persist in proposing new SO_2 monitoring sites near the Labadie plant in the 2015 Monitoring Network Plan, then based on currently-available modeling, one of the two proposed new monitoring sites near the plant is not located in an area where peak SO_2 concentrations are expected to occur and should be relocated. A third monitoring site should also be added southeast of the plant. Similarly, based on currently-available modeling, two of the three proposed new monitoring sites near Ameren's Rush Island plant are not located in areas where peak SO_2 concentrations are expected to occur and should be relocated.[2] These changes are necessary to ensure that the Labadie and Rush Island monitors capture maximum ambient SO_2 concentrations near these large sources.

This letter highlights the following key points:

- It is premature to site and install new SO_2 monitors at the Labadie plant until EPA completes an area designation for the plant.
- While DNR plans to use the proposed new Labadie and Rush Island monitors as State and Local Air Monitoring Stations ("SLAMS"),[3] it is not submitting them for EPA approval as required for SLAMS.

[1] MO DEP'T OF NATURAL RES. AIR POLLUTION CONTROL PROGRAM, 2015 MONITORING NETWORK PLAN, June 12, 2015 ("2015 Monitoring Network Plan").
[2] The three proposed new SO_2 monitoring sites that should be relocated, as discussed more fully below, are the Valley site near Ameren's Labadie plant and the Natchez and Weaver-AA sites near Ameren's Rush Island plant.
[3] 2015 Monitoring Network Plan at 12.

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Exhibit2

- Based on currently-available modeling, one of the two proposed new Labadie monitoring sites and two of the three proposed new Rush Island monitoring sites are unlikely to capture maximum ambient SO_2 concentrations because they are not located in areas where peak SO_2 concentrations are expected to occur.
- DNR has not adequately justified the locations of the proposed new Labadie and Rush Island monitoring sites. The support offered for the monitoring site locations in DNR's plan was provided by Ameren (Appendices 2 and 4). DNR visually observed the proposed sites at both plants but only performed independent modeling - which does not entirely support Ameren's proposed locations - regarding the Rush Island sites (Appendix 5). DNR did not perform independent modeling regarding the Labadie sites.

I. DNR Should Refrain From Proposing New SO_2 Monitoring Sites Near Ameren's Labadie Plant Until EPA Completes An Area Designation For The Plant.

It is premature to determine SO_2 monitoring site locations near the Labadie plant. DNR is about to propose a nonattainment area boundary recommendation for the Labadie plant,[4] and EPA must make a final area designation for the plant by July 2016.[5] While the Ameren modeling used to site the Labadie monitors in the 2015 Monitoring Network Plan was performed in a manner inconsistent with current EPA guidance, the modeling used to determine the nonattainment area boundary will identify areas of peak ambient SO_2 concentrations around the plant using current EPA guidance. It is likely that the Labadie monitors will ultimately be used to determine whether the nonattainment area comes into attainment, and they must be properly sited in order to provide reliable data.

The only modeling offered to support the proposed new Labadie monitoring sites was performed by Ameren in 2012.[6] Whereas DNR performed independent modeling to assess Ameren's proposed Rush Island monitoring sites (discussed in III.B. below), DNR did not perform independent modeling to assess Ameren's proposed Labadie monitoring sites. The 2015 Monitoring Network Plan states that DNR conducted "a review of relative dispersion modeling, local meteorological evaluation methodology submitted by Ameren UE, historical departmental SLAMS SO_2 monitoring data, nearby meteorological stations, and local topography."[7] However, only Ameren's modeling pointed to the proposed monitor locations. The other information either pointed to different locations or supported no particular monitoring site location. For example, the historical analysis of the former Augusta and Augusta Quarry monitors concluded where *not* to place monitors,[8] but did not point to a location that would accurately represent the highest ambient SO_2 concentration near the Labadie plant.[9] In addition, the analysis of wind

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[4] DNR has announced that it will propose a Labadie designation by July 27, 2015.
[5] Sierra Club v. Gina McCarthy, No. 3:13-cv-3953-SI (Consent Decree, March 2, 2015).
[6] 2015 Monitoring Network Plan, Appendix 3.
[7] 2015 Monitoring Network Plan at 14.
[8] The Augusta Quarry data analysis suggests that the plant was responsible for high concentrations near the quarry. *Id.* at 15-19. Without comparative conditions between current proposed monitor locations and the historical monitor locations, the historical data is irrelevant to locating the proper sites for new monitors.
[9] *Id.*

direction through the valley points to placing monitor(s) either to the northeast or southwest of the plant,[10] but it is too vague to support any specific monitoring site location.

The reliance upon Ameren's modeling would not be so concerning if Ameren had proposed monitors in locations with the highest modeled SO_2 concentrations around Labadie. However, one of Ameren's two proposed monitoring sites is outside any of the three areas where its modeling predicted peak SO_2 concentrations are expected to occur, leaving two of the three peak concentration areas completely unmonitored. In addition, Ameren's modeling does not comport with EPA guidance.

In sum, DNR should not propose any Labadie monitoring sites until EPA completes an area designation for the plant because 1) DNR will have to perform modeling that comports with EPA guidance as part of the Labadie designation process; 2) DNR intends to use the Labadie monitoring data in assessing whether the nonattainment area ultimately comes into attainment;[11] and 3) the Clean Air Act requires that monitors sited for National Ambient Air Quality Standard ("NAAQS") compliance purposes be incorporated into the state's monitoring network, subject to EPA review and approval.[12]

II. DNR Should Seek EPA Approval For The Proposed New Labadie And Rush Island SO_2 Monitors Because It Intends To Use Them As SLAMS.

The 2015 Monitoring Network Plan adds two new SO_2 monitors near Ameren's Labadie plant[13] and three new SO_2 monitors near Ameren's Rush Island plant.[14] The plan labels these as Special Purpose Monitors ("SPMs"), but states that "it is the intention to convert these monitors to SLAMS" once EPA finalizes the proposed Data Requirements Rule.[15]

Because DNR plans to use data from these new monitors to assess compliance with the 2010 1-hour SO_2 NAAQS, and because the Rush Island monitors are part of the Jefferson County Nonattainment State Implementation Plan ("SIP"), the siting of these monitors should be subject to EPA approval as required for SLAMS.[16] Indeed, it is unclear why the 2015 Monitoring Network Plan does not formally propose these new monitors as SLAMS.

Ameren proposed the Labadie monitoring sites to DNR and then constructed and began operating them just before the 2015 Monitoring Network Plan was published.[17] DNR approved the Labadie monitoring sites without conducting an independent modeling analysis to determine whether they are located in areas where peak SO_2 concentrations are expected to occur, without

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[10] *Id.* at 19-20.
[11] 2015 Monitoring Network Plan at 12.
[12] Clean Air Act § 110 (a)(2)(B), 42 U.S.C. § 7410(a)(2)(B); 40 CFR § 58.10.
[13] 2015 Monitoring Network Plan at 12-21.
[14] *Id.* at 22-23.
[15] EPA expects to publish the final Data Requirements Rule in October 2015. http://yosemite.epa.gov/opei/rulegate.nsf/byRIN/2060-AR19.
[16] 40 C.F.R. § 58.10(a)(2) and (e).
[17] DNR approved Ameren's proposed Labadie monitoring sites on May 1, 2015, and published the 2015 Monitoring Network Plan on June 12, 2015.

providing for public notice and comment, and without submitting the proposed monitor locations to EPA for its review and approval.

With respect to Rush Island, DNR submitted the Jefferson County Nonattainment SIP to EPA for review and approval on or about June 1. While it contained the requirement for Ameren to propose, build, and operate SO_2 monitoring sites at Rush Island, it did not identify the proposed Rush Island monitoring sites included in the 2015 Monitoring Network Plan published 11 days later on June 12, 2015.

Given DNR's stated intention to convert these monitors to SLAMS once EPA finalizes the proposed Data Requirements Rule – which it is expected to do in the next few months – the only salient difference between proposing them as SPMs rather than SLAMS in the 2015 Monitoring Network Plan is that EPA does not have to approve their locations. If DNR were to propose them as SLAMS in the 2015 Monitoring Network Plan or simply wait a few months and propose them as SLAMS after the final Data Requirements Rule is published, EPA *would* have to approve their locations. Proposing them as SPMs now when they will likely be converted to SLAMS in just a few months is suspect because, practically, it will be more difficult for EPA to object to the poor siting of the monitors and require that they be relocated after they are in operation.

The purpose of the NAAQS is to protect the public health.[18] Therefore, NAAQS compliance decisions must be based on properly-sited monitors designed to record maximum ambient SO_2 concentrations. Because one of the proposed new Labadie monitoring sites and two of the proposed new Rush Island monitoring sites are not located in areas of anticipated maximum ambient SO_2 concentrations (based on currently-available modeling), those monitors should be relocated – regardless of whether they are currently labeled SPMs or SLAMS. And EPA should notify DNR and Ameren that it will not accept data from those monitors for NAAQS compliance purposes unless they are appropriately relocated. Moreover, EPA should notify DNR and Ameren that it is premature to determine appropriate monitoring site locations for the Labadie plant until it completes an area designation for the plant.

III. Based On Currently-Available Modeling, Three Of The Five Proposed New Labadie And Rush Island Monitoring Sites Are Not Located In Areas Of Anticipated Maximum Ambient SO_2 Concentrations.

EPA regulations and guidance require ambient SO_2 monitors to be sited where peak concentrations are expected to occur.[19] With respect to source-oriented SO_2 monitoring, EPA guidance states:

> The primary objective is to place monitoring sites at the location or locations of expected peak concentrations.[20]

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[18] Clean Air Act § 109(b)(1), 42 U.S.C. § 7409(b)(1).
[19] 40 C.F.R. Part 58, Appendix D, § 1.1.1(a), (c). See also U.S. EPA: OFFICE OF AIR AND RADIATION, OFFICE OF AIR QUALITY PLANNING AND STANDARDS, AIR QUALITY ASSESSMENT DIVISION, SO_2 NAAQS DESIGNATIONS SOURCE-ORIENTED MONITORING TECHNICAL ASSISTANCE DOCUMENT, Dec. 2013 ("SO_2 Monitoring TAD").
[20] SO_2 Monitoring TAD at 16.

Further, the Consent Agreement between DNR and Ameren that is included in both the Jefferson County SIP and the 2015 Monitoring Network Plan requires that the monitoring at Rush Island "represents ambient air quality in areas of maximum SO_2 impact from the Rush Island Energy Center."[21]

However, one of the two proposed new Labadie monitoring sites and two of the three proposed new Rush Island monitoring sites are not located in the areas where peak SO_2 concentrations are expected to occur based on Ameren's and DNR's modeling.

On behalf of the Sierra Club, we previously critiqued Ameren's proposed Labadie and Rush Island monitoring site locations in letters submitted to DNR. Those letters are attached as Exhibits 1 and 2 and hereby incorporated by reference.

A. Based On Currently-Available Modeling, One Of The Two Proposed New Labadie Monitoring Sites Should Be Relocated, And A Third Monitor Should Be Added Southeast of the Plant.

In our April 13, 2015 comments to DNR on Ameren's proposed new Labadie monitoring sites, attached as Exhibit 1, we demonstrated that one of the proposed sites – the Valley site – is not located in any of the areas where Ameren's modeling predicts peak SO_2 concentrations are expected to occur. Ameren's modeling identified three distinct areas where the highest SO_2 concentrations are expected to occur and where high concentrations are expected to occur most frequently. These areas are located northwest, northeast, and southeast of the plant and are shown in Figure 1 below. However, only one of the two proposed Labadie monitoring sites – the Northwest site – is located in one of these peak concentration areas (the one located northwest of the plant). The Valley site is located between the other two peak concentration areas, in an area where the modeled concentration is only about 80 percent of the maximum concentration predicted by the model. As a result, it is unlikely to capture maximum ambient SO_2 concentrations and should be relocated to the peak concentration area northeast of the plant.

In addition, DNR should also require the installation of a third monitor in the peak concentration area southeast of the plant lest anticipated maximum ambient SO_2 concentrations in this area – which are likely to have implications for NAAQS compliance – go undetected by the Labadie SO_2 monitoring network.

B. Two Of The Three Proposed New Rush Island Monitors Should Also Be Relocated.

In our May 29, 2015 comments to DNR on Ameren's proposed new Rush Island monitoring sites, attached as Exhibit 2, we demonstrated that all three of the proposed sites, but especially the Natchez and Weaver-AA sites, are located outside areas where Ameren's modeling predicts peak SO_2 concentrations are expected to occur. DNR has since performed an independent modeling evaluation of the proposed sites which follows EPA guidance more closely and is

[21] 2015 Monitoring Network Plan, Appendix 3, 2015 Ameren Missouri and Missouri Department of Natural Resources Consent Agreement, Appendix A, ¶ b, at 13 of 15.

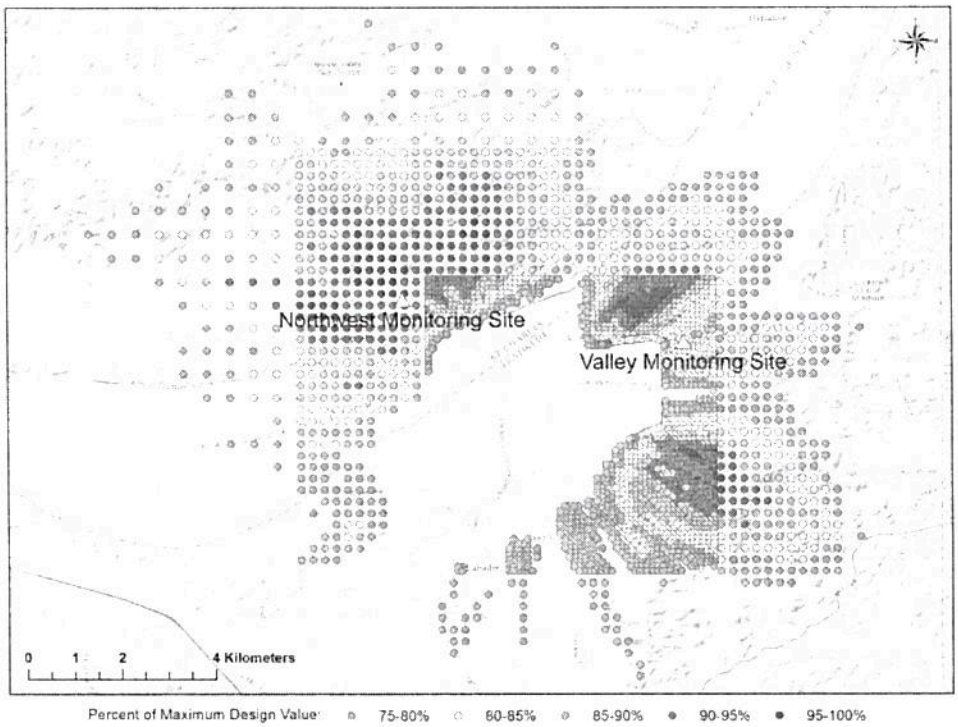


Figure 1. Modeled peak concentration areas near Ameren's Labadie plant.

therefore more reliable than Ameren's modeling. While DNR concluded that the proposed sites are properly located in areas where peak SO_2 concentrations are expected to occur, there is a significant flaw in DNR's analysis that, when corrected, confirms that the Natchez and Weaver-AA sites are located outside of peak concentration areas and should be relocated.

The stated purpose of DNR's evaluation of the proposed new Rush Island monitoring sites was to determine if the sites "will adequately represent Rush Island Energy Center's SO_2 air quality impact." DNR used hourly emission rates from EPA's Air Markets Program in its modeling as recommended in EPA's SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document whereas Ameren used constant emission rates.[22]

However, DNR's analysis of its modeling is based on a methodology that inherently biases the results. DNR used a telescoping receptor grid in its modeling; specifically, it used a 100-meter receptor spacing out to 1 kilometer, a 250-meter spacing out to 3.5 kilometers, a 500-meter spacing out to 10 kilometers, and a 1,000-meter spacing out to 50 kilometers. In order to identify areas where peak SO_2 concentrations are expected to occur, it plotted the predicted SO_2 design value at each receptor and drew polygons around high concentration areas by including all receptors with concentrations greater than 90 ug/m^3. This is shown in Figure 2 below. DNR then

[22] However, neither Ameren nor DNR included interactive sources as recommended by EPA guidance. See Exhibit 2 at 9.

counted the number of high concentration receptors (i.e., receptors with concentrations greater than 90 ug/m^3) in each polygon and ranked the polygons from highest to lowest in terms of the number of high concentration receptors they contained. The results of this analysis are summarized in Table 1 below.

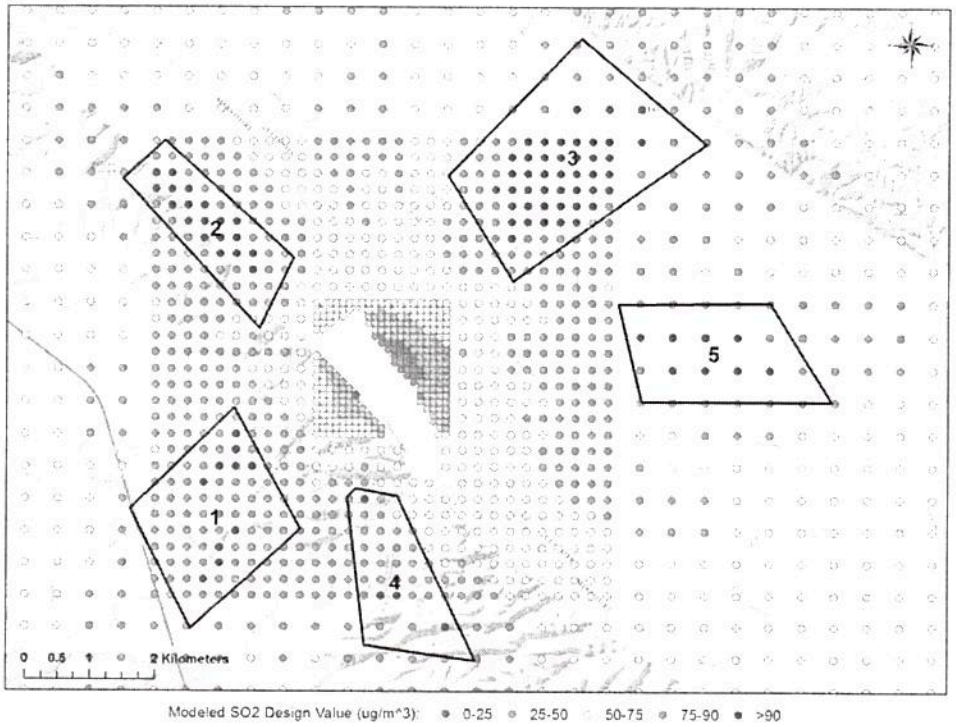


Figure 2. DNR model results and polygons drawn around high concentration areas.

Table 1. Number of high concentration receptors in DNR's polygons.

	Polygon 1	Polygon 2	Polygon 3	Polygon 4	Polygon 5
# of Receptors >90 ug/m^3	10	18	45	4	8
Ranking: 3>2>1>5>4					

Based on this analysis, DNR concluded that polygons 3 and 2, which contained the highest and second-highest number of high concentration receptors, represented "areas of maximum concentration" and were therefore "candidates for the location of SO_2 monitors."[23] It then determined, based on a qualitative analysis of wind speed and direction and the number of high

[23] 2015 Monitoring Network Plan, Appendix 5, Review of Proposed SO_2 and Meteorological Monitoring Stations Around Ameren Missouri's Rush Island Energy Center, at 4.

concentration receptors in the remaining three polygons (i.e., 1, 4 and 5), that polygon 1 was the best candidate of the remaining three for the location of a third SO_2 monitor. Based on these findings, DNR concluded that because the three new monitoring sites proposed by Ameren are located within polygons 1, 2 and 3, they are within areas where peak SO_2 concentrations are expected to occur and are therefore appropriately sited.

However, because DNR used a telescoping receptor grid, and because the polygons it drew to indicate areas of high concentration are located in a region where the receptor grid spacing varies from 250 to 500 meters, DNR's counts of high concentration receptors in each polygon and its subsequent ranking of the polygons based on those counts are significantly biased. Some of DNR's polygons are likely to have more high concentration receptors than others just by virtue of the fact that the receptors in those polygons are spaced more closely together than they are in other polygons. For example, almost all of the receptors in polygons 1 and 2 are spaced 250 meters apart, whereas all of the receptors in polygon 5 are spaced 500 meters apart. As a result there are many more receptors – including more high concentration receptors – in polygons 1 and 2 than in polygon 5 despite the fact that all three polygons are similar in size (polygon 5 is slightly larger than polygon 2 and slightly smaller than polygon 1).

One way to eliminate the counting bias resulting from DNR's use of a telescoping receptor grid is by ranking the polygons based on the percentage instead of the absolute number of high concentration receptors within each one. This effectively adjusts for the fact that certain polygons, e.g., polygons 1 and 2, are likely to have more high concentration receptors than others, e.g., polygon 5, just by virtue of the fact that the receptors in those polygons are spaced more closely together. The results of this analysis are summarized in Table 2 below. Polygon 3 is still ranked the highest. However, polygon 5 is ranked second-highest instead of polygon 2, which drops to third-highest – displacing polygon 1 from the top three.

Table 2. Percentage of high concentration receptors in DNR's polygons.

	Polygon 1	Polygon 2	Polygon 3	Polygon 4	Polygon 5
% of Receptors >90 ug/m^3	15	44	67	14	62
Ranking: 3>5>2>1>4					

A better way to eliminate the counting bias resulting from DNR's use of a telescoping receptor grid is to replace the telescoping grid with a uniform grid so the receptor spacing is the same in all five polygons. To determine how this would affect receptor counts and polygon ranks, we re-ran DNR's model using a uniform 250-meter receptor spacing and analyzed the results using DNR's methodology. The results are shown in Figure 3 below, and the number of high concentration receptors in each polygon and the ranking of polygons from highest to lowest in terms of the number of high concentration receptors they contain are summarized in Table 3 below. We also ranked the polygons based on the percentage instead of the absolute number of

high concentration receptors within each one. The results of this analysis are summarized in Table 4 below.

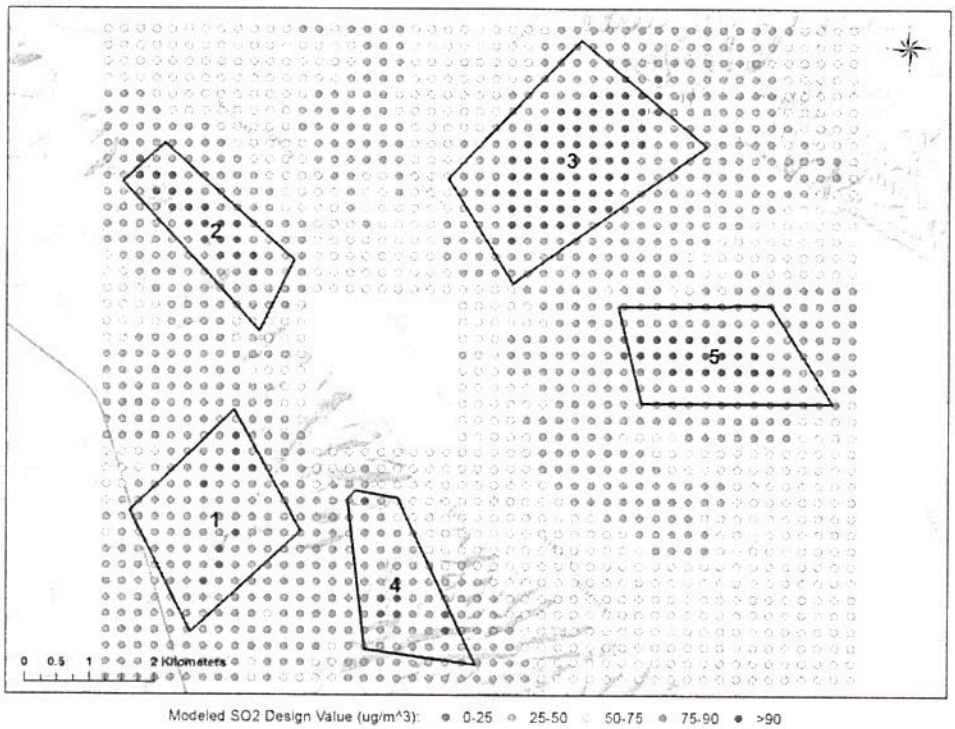


Figure 3. DNR model results for uniform 250-meter receptor grid.

Table 3. Number of high concentration receptors in DNR's polygons when modeled with a uniform receptor grid.

	Polygon 1	Polygon 2	Polygon 3	Polygon 4	Polygon 5
# of Receptors >90 ug/m^3	10	20	63	7	22
Ranking: 3>5>2>1>4					

Table 4. Percentage of high concentration receptors in DNR's polygons when modeled with a uniform receptor grid.

	Polygon 1	Polygon 2	Polygon 3	Polygon 4	Polygon 5
% of Receptors >90 ug/m^3	14	45	55	16	39
Ranking: 3>2>5>4>1					

When modeled with a uniform receptor grid, the three highest ranking polygons – both in terms of the number and percentage of high concentration receptors they contain – are 2, 3 and 5, **not** 1, 2 and 3 as DNR's flawed analysis concluded. These are the areas predicted to have the highest modeled impacts and thus where SO_2 monitoring sites should be located. An analysis of the top 10, 25, and 50 receptors supports this conclusion. All but one of the top 10 receptors are located within polygon 3, all but one of the top 25 receptors are located within polygons 2 and 3, and all but one of the top 50 receptors are located within polygons 2, 3 and 5. This is shown in Figure 4 below, which includes a filled contour plot of modeled design values that clearly shows how much larger the peak concentration areas are in polygons 2, 3 and 5 compared to the other polygons.

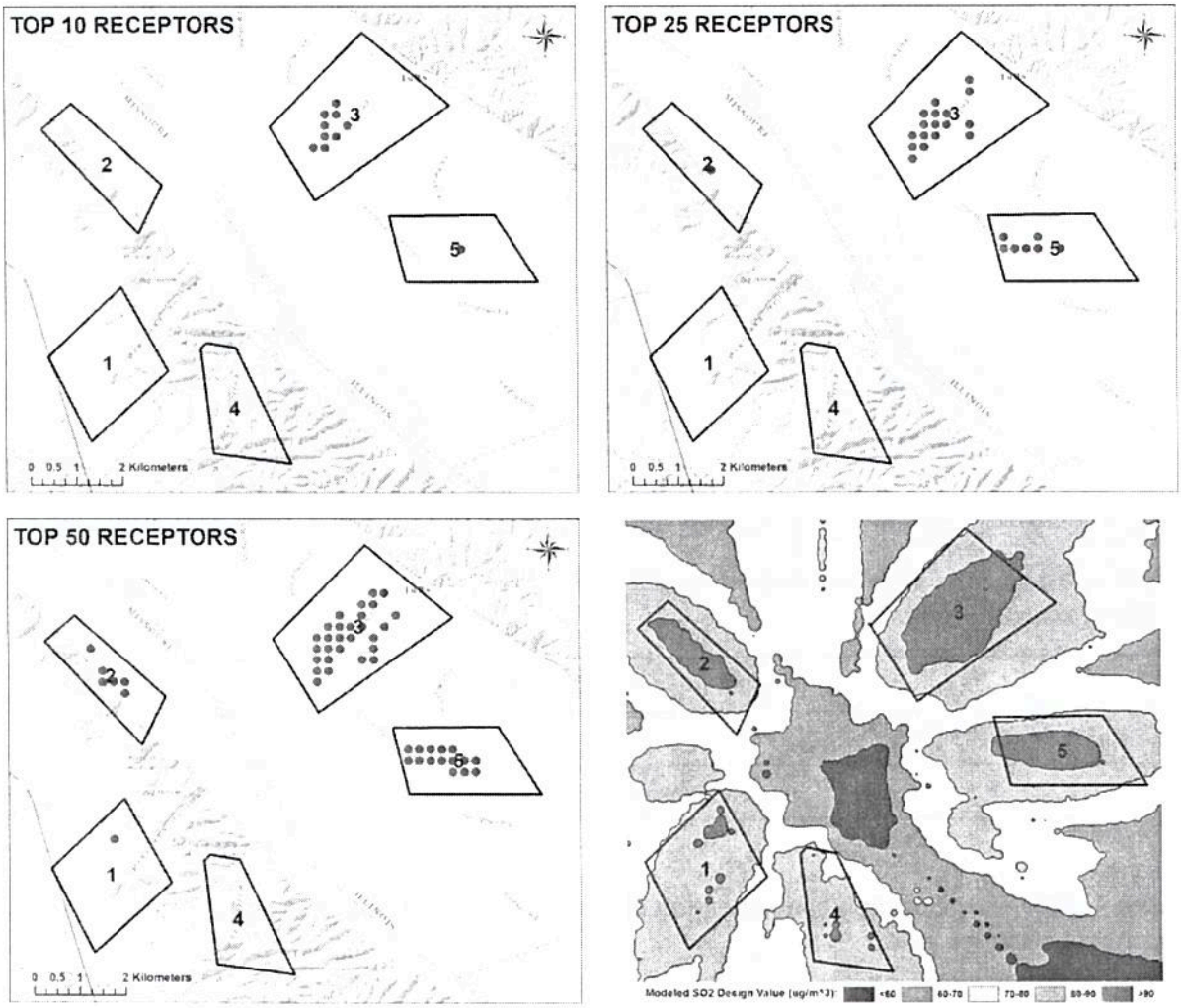


Figure 4. Top 10, 25 and 50 receptors and filled contour plot of modeled design values.

The locations of Ameren's proposed SO_2 monitoring sites – dubbed Fults, Natchez and Weaver-AA – relative to DNR's polygons are shown in Figure 5 below. Of the three proposed sites, only the Fults site, which is inside the peak concentration area within polygon 3, is properly located. The Weaver-AA site, which Figure 2 of Monitoring Network Plan Appendix 5 incorrectly shows being within polygon 2, is actually located outside of it based on the site coordinates provided in Plan Appendix 1. Hence it is not properly located. Nor is the Natchez site, which should be located within polygon 5 instead of polygon 1 because polygon 5 has higher modeled impacts.

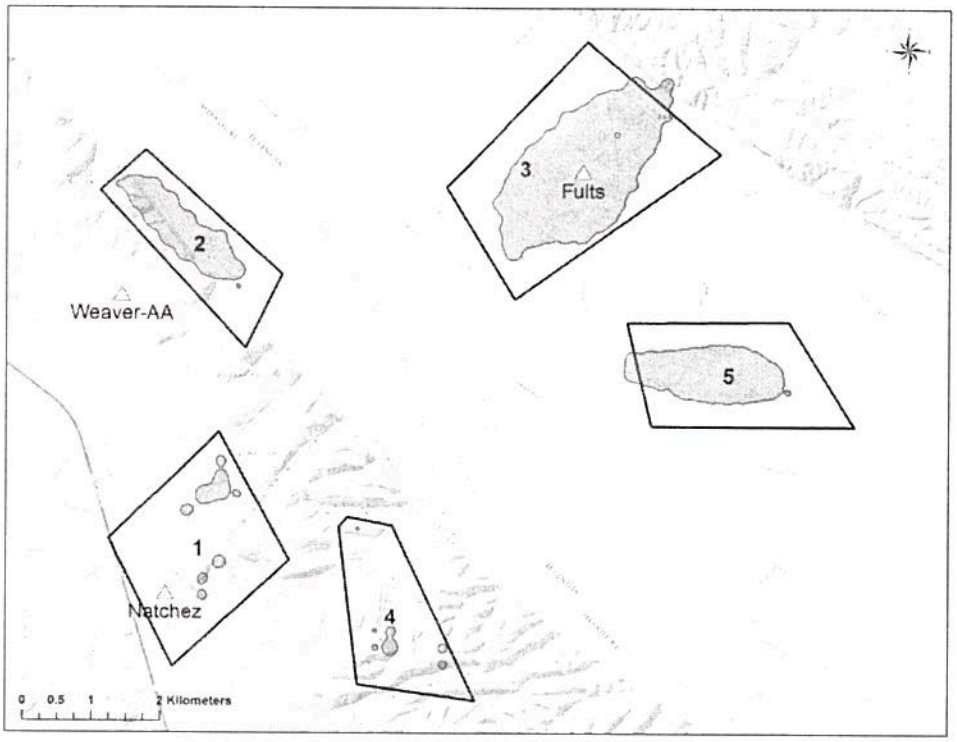


Figure 5. Ameren's proposed SO_2 monitoring sites relative to DNR's polygons. Peak concentration areas (>90 ug/m^3) are shaded red.

Because they are not properly located, neither the Natchez nor Weaver-AA monitoring sites will adequately represent Rush Island's SO_2 air quality impact. Therefore, both sites should be relocated. The Weaver-AA site should be located inside the peak concentration area within polygon 2 and the Natchez site should be located inside the peak concentration area within polygon 5 as shown in Figure 6 below. Alternatively, the Natchez site could be moved inside the peak concentration area within polygon 1 and a fourth monitor added inside the peak concentration area within polygon 5 as shown in Figure 7 below. The recommended monitor locations shown in Figures 6 and 7 are easily accessible and appear to meet EPA siting criteria and have ready access to power.

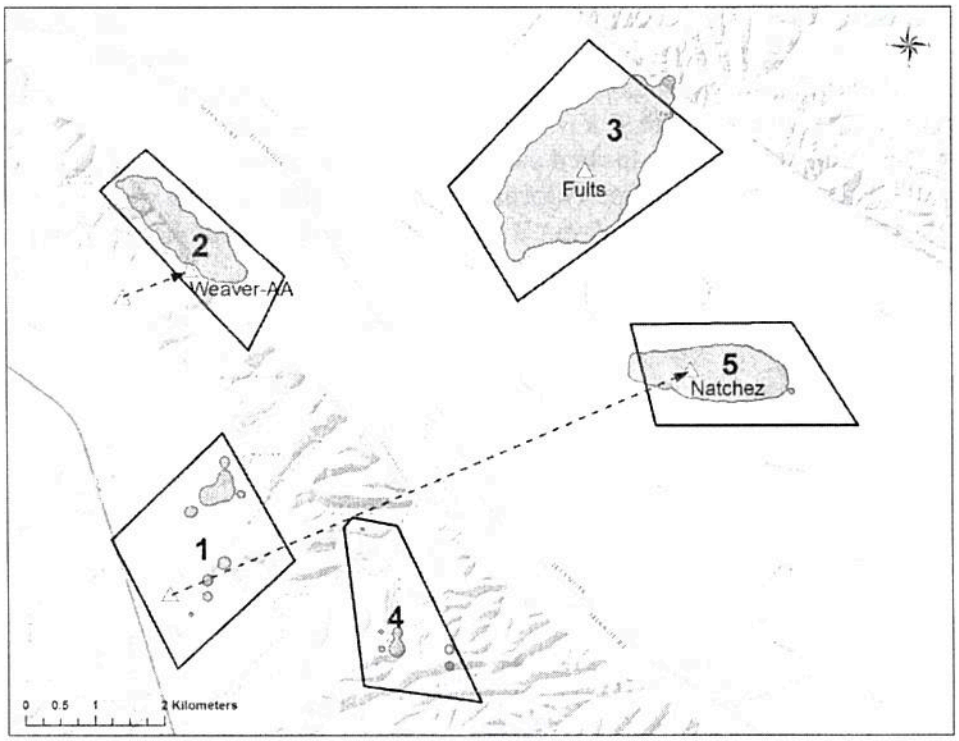


Figure 6. Appropriately located Rush Island monitors (three monitor configuration).

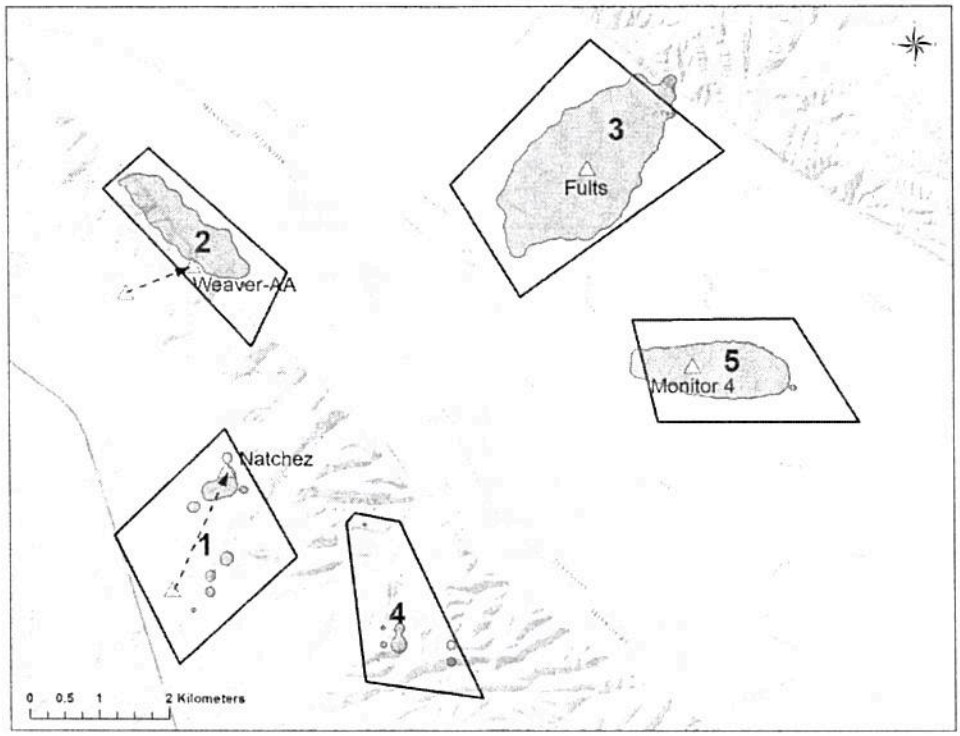
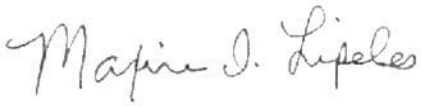


Figure 7. Appropriately located Rush Island monitors (four monitor configuration).

IV. Conclusion

For the reasons set forth above, DNR should withdraw the proposed Labadie SO_2 monitoring sites and EPA should not approve the 2015 Monitoring Network Plan with the inclusion of such sites pending the completion of the Labadie area designation process and the performance of appropriate modeling to determine the areas of peak ambient SO_2 concentrations around the plant using current EPA guidance. With respect to the Rush Island monitoring sites in the 2015 Monitoring Network Plan (and the Labadie monitoring sites if DNR does not withdraw them), DNR should not submit the plan to EPA, and EPA should not approve it, unless and until the proposed monitoring sites are relocated to areas of expected peak ambient SO_2 concentrations.

Sincerely yours,



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Interdisciplinary Environmental Clinic

April 13, 2015

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Via email to patricia.maliro@dnr.mo.gov

Re: Comments on Ameren Missouri's Labadie Sulfur Reduction Project Quality Assurance Project Plan

Dear Ms. Maliro:

On behalf of the Sierra Club, we submit the following comments on Ameren Missouri's Labadie Sulfur Reduction Project Quality Assurance Project Plan (QAPP). The QAPP describes the methodology Ameren used to determine the locations of two proposed ambient sulfur dioxide (SO_2) monitoring stations around its Labadie Energy Center in connection with the 1-hour SO_2 National Ambient Air Quality Standard (NAAQS). We believe the QAPP should be disapproved because the proposed monitoring stations are improperly sited; they are outside areas where peak 1-hour SO_2 concentrations are expected to occur based on the modeling described in the QAPP. Furthermore, the modeling described in the QAPP does not comport with EPA guidance on characterizing ambient air quality in areas around or impacted by significant SO_2 emission sources such as the Labadie Energy Center and therefore may have failed to correctly identify areas of expected ambient, ground-level SO_2 concentration maxima.

I. Based on the Modeling Described in the QAPP, the Proposed Monitoring Stations are Improperly Sited Outside Areas Where Peak 1-Hour SO_2 Concentrations are Expected to Occur

Appendix 10 of the QAPP describes the modeling performed to determine the locations of the proposed ambient SO_2 monitoring stations around the Labadie Energy Center. The modeling was used to determine locations where peak 1-hour SO_2 concentrations are expected to occur due to the plant's SO_2 emissions given that the primary objective of source-oriented monitoring is to identify peak SO_2 concentrations in ambient air that are attributable to an identified emission source or group of sources.[1] Figure 1 shows all receptors with modeled design values greater than or equal to 75 percent of the maximum modeled design value. Figure 2 shows the receptors with the top 200, 100, 25, and 10 modeled design values.

[1] U.S. EPA, SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, at 2.

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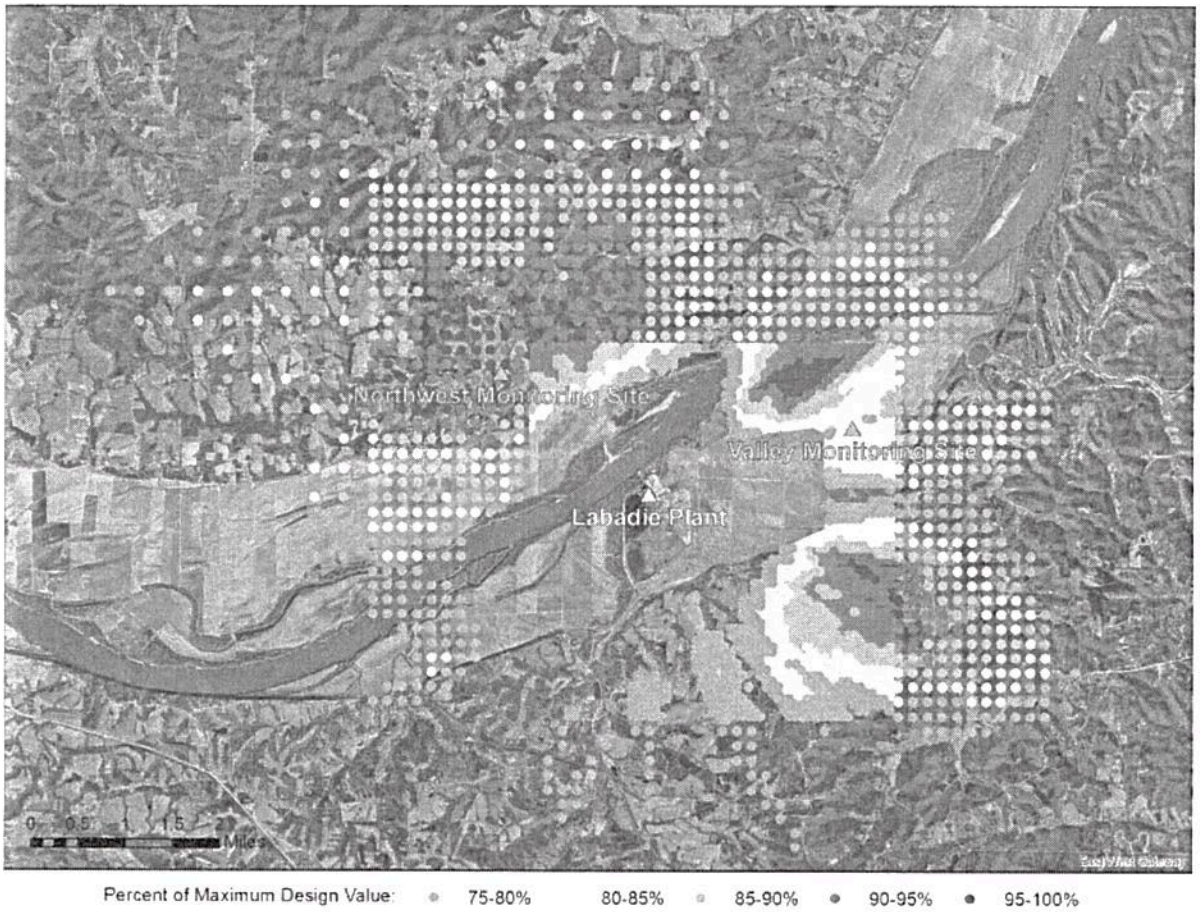

Figure 1. Receptors with modeled design values ≥75 percent of the maximum design value.

The modeling was also used to determine locations where elevated SO_2 concentrations are expected to occur most frequently given that the site selection process also needs to account for the frequency with which an area sees the daily maximum concentration.[2] Normally this involves counting the number of times each receptor sees the daily maximum 1-hour SO_2 concentration predicted by the model. However, the QAPP looks at it differently, counting instead the number of times the daily maximum 1-hour SO_2 concentration at each receptor exceeds 75 percent of the maximum modeled design value. Figure 3, which is reproduced from the QAPP,[3] shows the number of daily maximum 1-hour SO_2 concentrations at each receptor that exceed 75 percent of the maximum modeled design value.

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[2] *Id.* at A-6.

[3] See Appendix 10, Figure 6, "Counts of Max Daily 1-Hour Concentrations Greater Than 75% of the Max Modeled Design Value* (Years 2005-2009)."

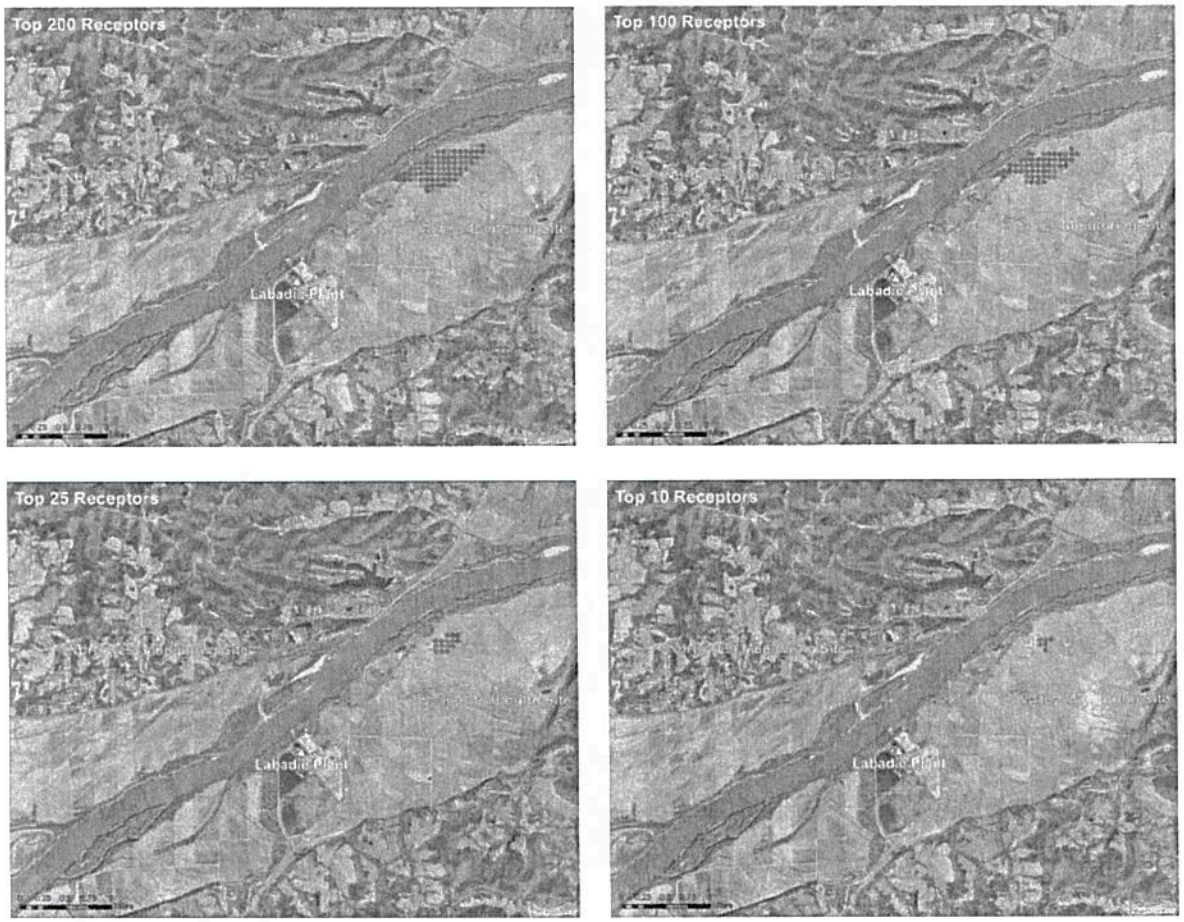

Figure 2. Receptors with the top 200, 100, 25, and 10 modeled design values.

Figures 1 and 2 reveal three distinct areas where modeled design values are in excess of 95 percent of the maximum modeled design value and where the majority of the top 200 receptors (and all of the top 100, 25 and 10 receptors) lie. These areas, located northwest, northeast, and southeast of the Labadie Energy Center, are where the modeling predicts peak 1-hour SO_2 concentrations are expected to occur. Furthermore, although a rigorous comparison is not possible without detailed receptor data, a simple visual comparison of Figures 1 and 3 indicates that the areas where peak 1-hour SO_2 concentrations are expected to occur (i.e., where modeled design values are in excess of 95 percent of the maximum modeled design value) overlap with the areas where daily maximum 1-hour SO_2 concentrations most frequently exceed 75 percent of the maximum modeled design value. Monitoring stations located in these areas would have the greatest chance of identifying peak SO_2 concentrations in ambient air, which is the primary objective of source-oriented monitoring and an absolute necessity when monitoring to assess compliance with the NAAQS.

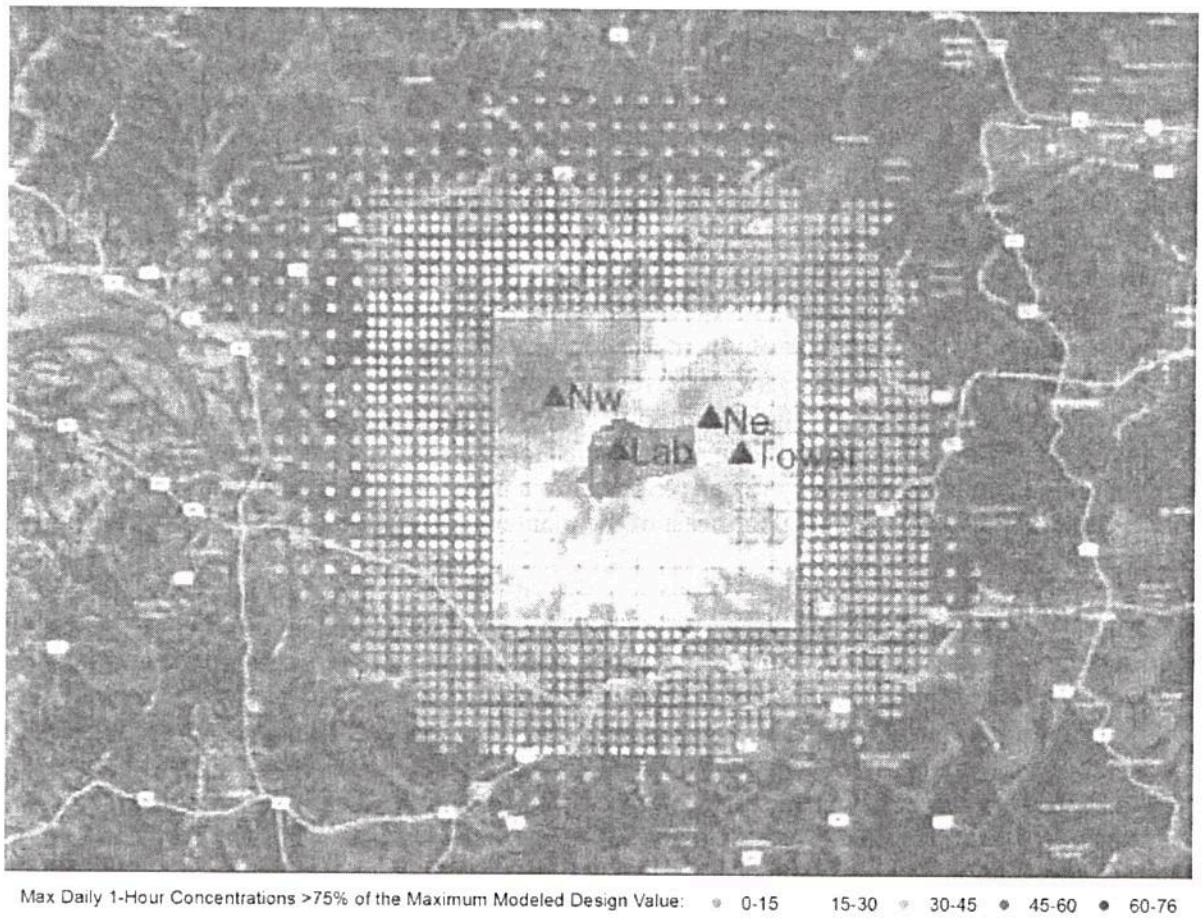

Figure 3. Number of maximum daily 1-hour SO_2 concentrations at each receptor that exceed 75 percent of the maximum modeled design value.

However, only one of Ameren's proposed monitoring sites, the northwest site, is located in one of the three peak concentration/high frequency areas predicted by the modeling (the one located northwest of the plant). No monitoring sites are proposed in the peak concentration/high frequency areas located northeast or southeast of the plant. Instead, Ameren's only other proposed monitoring site, the valley site, is located in an area where modeled design values are only about 80 percent of the maximum modeled design value and where daily maximum 1-hour SO_2 concentrations exceed 75 percent of the maximum modeled design value about half as often as they do in areas where this occurs with the greatest frequency. This makes the valley site an inappropriate site for a monitor to assess compliance with the NAAQS. Ameren's modeling predicts that ambient SO_2 concentrations will be as much as 25 percent higher in several areas around the plant than they will be at the valley site, meaning a monitoring station at the valley site could be in compliance with the NAAQS while significant violations were occurring nearby.

The QAPP states that a monitor could not be sited in the peak concentration/high frequency area northeast of the plant because it is an actively farmed area, physical access is almost impossible

without building additional infrastructure, and electric power is not available. These justifications do not stand up to the barest scrutiny. The entire Labadie Bottoms is an actively farmed area, accessible only by unimproved roads that severely limit vehicular access during wet weather conditions. As such, the proposed valley monitoring site is no more accessible than a site within the peak concentration/high frequency area northeast of the plant would be, and additional road infrastructure will likely be necessary for all-weather access regardless of where in the Labadie Bottoms the monitor is located.[4] Furthermore, electric power is not available anywhere within the Labadie Bottoms, including at the proposed valley monitoring site. Therefore, distribution infrastructure will have to be built to deliver power to any monitoring site in the Labadie Bottoms regardless of where it is located. The St. Albans Water and Sewer Authority/Franklin County PWSD #3 wastewater treatment facility, located approximately 1 kilometer east of the proposed valley monitoring site, appears to be the closest available source of electric power for monitoring sites in the Labadie Bottoms, and only a minimal amount of additional line would be necessary to deliver power to a monitor located in the peak concentration/high frequency area northeast of the plant compared to one located at the proposed valley monitoring site.

The QAPP's justification for not siting a monitor in the peak concentration/high frequency area southeast of the plant is equally flimsy. The QAPP states that the primary reason a monitor is not proposed in that area – despite the model predicting high design values and a high number of daily maximum 1-hour SO_2 concentrations in excess of 75 percent of the maximum modeled design value in that area – is because the elevated terrain there is similar to the terrain at the proposed northwest monitoring site and it was believed an additional elevated terrain site was not necessary. However, AERMOD accounts for terrain influences when calculating modeled design values, and variations in meteorological parameters, most notably wind direction, often result in peak 1-hour SO_2 concentrations occurring in different areas that have similar terrain (e.g., areas in different cardinal directions from the source). Therefore, the peak concentration/high frequency area southeast of the plant cannot be ignored simply because the terrain there is similar to the terrain in the peak concentration/high frequency area northwest of the plant. The purpose of an ambient SO_2 monitoring network is not to monitor different terrain types, but to monitor areas where peak 1-hour SO_2 concentrations are expected to occur regardless of the terrain in those areas. The QAPP also suggests that the high concentrations and frequencies predicted by the model southeast of plant are merely an artifact of the Jefferson City, MO Airport meteorology, which is influenced by the local orientation of the Missouri River valley at that met station. However, the wind roses provided in the QAPP for a number of met stations in eastern Missouri that are closer to Labadie, which the QAPP states better reflect the expected meteorology at Labadie, all show significant winds from the north or northwest, which is consistent with an area of peak concentration/high frequency southeast of the plant.

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[4] The peak concentration/high frequency area northeast of the plant is arguably more accessible than the proposed valley monitoring site given its proximity to the agricultural levee adjacent to the south bank of the Missouri River. The road on the crest of this levee is higher and most likely drier than other unimproved roads in the Labadie Bottoms, including those roads leading to the proposed valley monitoring site.

II. The Modeling Described in the QAPP Does Not Comport With EPA's Source-Oriented SO_2 Monitoring Guidance and Therefore May Not Correctly Identify Areas of Expected Ambient, Ground-Level SO_2 Concentration Maxima

EPA's SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document (TAD) provides guidance on how to "appropriately and sufficiently monitor ambient air in areas proximate to or impacted by an SO_2 emissions source to create ambient monitoring data for comparison to the SO_2 NAAQS" and presents "recommended steps to aid in identifying source-oriented SO_2 monitor sites."[5] The modeling described in the QAPP fails to adhere to the TAD in one critical respect: it does not use hourly emission rates, which are readily available for Labadie's boilers from EPA's online Air Markets Program Data tool. Instead it uses constant emission rates, which the QAPP states were "selected to produce rational ambient levels to be used for establishing monitoring locations and does not reflect actual emissions." The consequence of using constant rather than hourly emission rates is that the effects of the interaction between hourly emissions and hourly variations in meteorological parameters is ignored completely, so that the predicted areas of peak concentration and/or high frequency are primarily a function of the meteorology used. For example, if peak hourly emissions coincide with times when strong winds blow from a direction other than the prevailing wind direction, a model that uses hourly emission rates might predict high concentrations in different areas than the same model would predict using constant emission rates. Therefore, using hourly emissions allows the areas where peak 1-hour SO_2 concentrations are expected to occur to be determined with greater confidence.

III. DNR Should Not Deprive The Public and EPA of an Opportunity to Participate in the Monitoring Site Selection Process.

While the area around the Labadie plant will necessarily be evaluated for nonattainment designation purposes based on modeling in order to meet the July 2016 deadline set by *Sierra Club et al. v. McCarthy*, Civil Action No. 3:13–cv–3953–SI (N.D. Cal., March 2, 2015), it is difficult to imagine why DNR and Ameren would agree to install monitoring sites near the Labadie plant unless they expect to consider using the results for future NAAQS compliance evaluations. Monitoring sites used for such purposes must be included in the state's monitoring network plan, which must be proposed by DNR after public notice and the opportunity for public comment, and submitted to EPA for its review and approval. 40 CFR § 58.10.

Contrary to these requirements, DNR has been working with Ameren to select the Labadie monitoring sites and allow Ameren to commence monitoring at these inappropriate locations without public notice and opportunity for public comment, and without submitting the plans to EPA for its review and approval. Documents obtained recently from DNR suggest that Ameren is already preparing to construct the monitoring sites identified in the Labadie QAPP. In addition, the Consent Agreement attached as Appendix J to the proposed Jefferson County State Implementation Plan requires Ameren to submit "final network site recommendations" to DNR regarding the Rush Island plant by May 1, 2015, with equipment to be installed and calibrated by

[5] U.S. EPA, SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, at 2.

December 31, 2015 – with no provisions for public comment or for EPA review and approval. Unlike Labadie, where Ameren has provided documentation to DNR as to its (flawed) basis for monitoring site selection, Ameren appears to be developing its "final network site recommendations" for Rush Island without the prior submission to DNR of modeling data to support the site selection.[6]

DNR should not approve monitoring locations for the Labadie or Rush Island plants without first providing public notice and opportunity for comment, and without submitting the proposed locations to EPA for its review and approval.

Conclusion

Based on the modeling described in the QAPP, Ameren's proposed valley monitoring site is improperly located in an area where peak 1-hour SO_2 concentrations are **not** expected to occur. Furthermore, Ameren has failed to propose monitoring sites in peak concentration/high frequency areas located northeast and southeast of the Labadie Energy Center, citing justifications that don't withstand the barest scrutiny, despite the facts that there are numerous private residences within the peak concentration/high frequency area southeast of the plant and the peak concentration/high frequency area northeast of the plant is situated between the nearby communities of St. Albans and Augusta Shores. Therefore, we urge DNR to disapprove the QAPP and require Ameren to make the following changes:

1) Relocate the proposed valley monitoring site to the peak concentration/high frequency area northeast of the plant; and
2) Add a third monitoring site in the peak concentration/high frequency area southeast of the plant.

We also urge DNR to require Ameren to rerun the air dispersion model described in the QAPP using hourly emission rates in order to determine whether the model correctly identified the areas of expected ambient, ground-level SO_2 concentration maxima around the plant and to require a wholesale reevaluation of potential monitoring sites if the model used for the QAPP failed to correctly identify such areas.

Finally, we urge DNR to provide public notice and opportunity for comment, and to submit the proposed monitoring locations to EPA for its review and approval, in accordance with 40 CFR Part 58.

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[6] On behalf of the Sierra Club, the Clinic has submitted Sunshine Law requests for documents related to possible SO_2 monitoring at Labadie and Rush Island. The most recent request to which DNR has responded (submitted on February 19, 2015, with responsive documents provided April 2, 2015), requested: "All documents regarding the possible installation of SO_2 monitors at the Labadie and/or Rush Island power plants, including but not limited to Quality Assurance Project Plans and all related documents, and all AERMOD input and output files used in any modeling analysis performed to determine the locations of any proposed SO_2 monitoring sites." As of DNR's latest response (April 2, 2015), it has not provided any documents discussing or attempting to justify the selection of possible modeling sites at the Rush Island plant.

Respectfully submitted,

Maxine I. Lipeles

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On behalf of the Sierra Club

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May 29, 2015

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Re: Comments on Ameren Missouri's Analysis of SO_2 and Meteorological Monitoring Stations Around Its Rush Island Energy Center

Dear Ms. Maliro:

On behalf of the Sierra Club, we submit the following comments on the report by Ameren Missouri titled Analysis of SO_2 and Meteorological Monitoring Stations Around Ameren Missouri's Rush Island Energy Center (Ameren's Monitoring Stations Analysis), which it submitted to DNR on or about April 29, 2015. The report describes the methodology Ameren used to determine the locations of three proposed ambient SO_2 monitoring stations and one meteorological monitoring station around its Rush Island Energy Center in Jefferson County, Missouri. Pursuant to a March 23, 2015 Consent Agreement with DNR, Ameren is required to install and begin operation of an SO_2 monitoring network around the Rush Island plant on or before December 31, 2015.

We believe Ameren's proposed monitoring sites should be rejected because they are located outside areas where peak 1-hour SO_2 concentrations are expected to occur based on the modeling described in Ameren's report. Furthermore, the modeling described in the report does not comport with EPA guidance on characterizing ambient air quality in areas around or impacted by significant SO_2 emission sources such as the Rush Island Energy Center and therefore may have failed to correctly identify areas of expected ambient, ground-level SO_2 concentration maxima. We also have concerns regarding the appropriateness of the meteorological data used in the modeling.

I. Based on the Modeling Described in Ameren's Report, the Proposed Monitoring Sites are Located Outside Areas Where Peak 1-Hour SO_2 Concentrations are Expected to Occur

The Consent Agreement (Appendix 1, ¶b) requires that "the number and location of SO_2 monitors and meteorological station(s) shall ensure that the approved SO_2 monitoring network represents ambient air quality in areas of maximum SO_2 impact from the Rush Island Energy Center." Ameren's Monitoring Stations Analysis (p. 3) describes the modeling it performed to

"delineate areas where maximum concentrations are expected to occur for this type of source and thus where SO_2 monitoring systems should be placed."

Unfortunately, the monitoring sites proposed by Ameren are not, in fact, located in "areas of maximum SO_2 impact from the Rush Island Energy Center," as required by the Consent Agreement.

Figures 1 through 4 below show the results of Ameren's modeling, which we derived using model input files provided by DNR. Figure 1 shows modeled SO_2 design values in the vicinity of the plant; Figure 2 shows receptors with modeled design values greater than or equal to 75 percent of the maximum modeled design value (146.1 ug/m^3); Figure 3 shows the number of times the model-derived maximum daily 1-hour concentration exceeded 75 percent of the maximum modeled design value at each receptor; and Figure 4 shows the receptors with the top 200, 100, 25, and 10 modeled design values. The locations of the plant and the proposed Fults, Natchez, and Weaver-AA SO_2 monitoring stations and the proposed Tall Tower meteorological monitoring station are shown on all figures for reference.

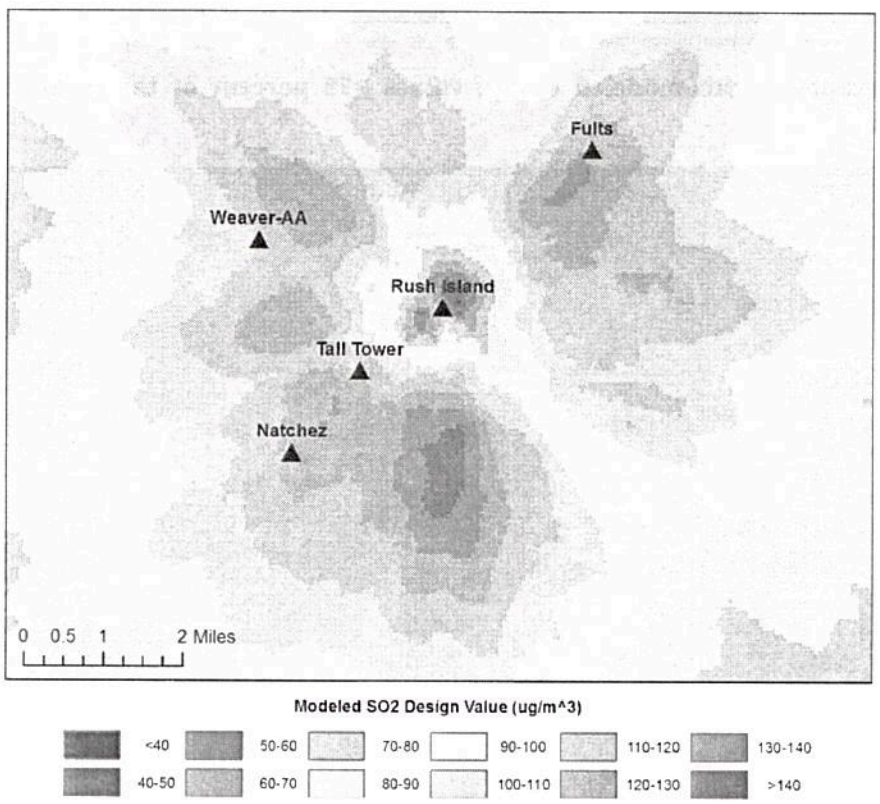

Figure 1. Modeled SO_2 design values in the vicinity of the Rush Island Energy Center.

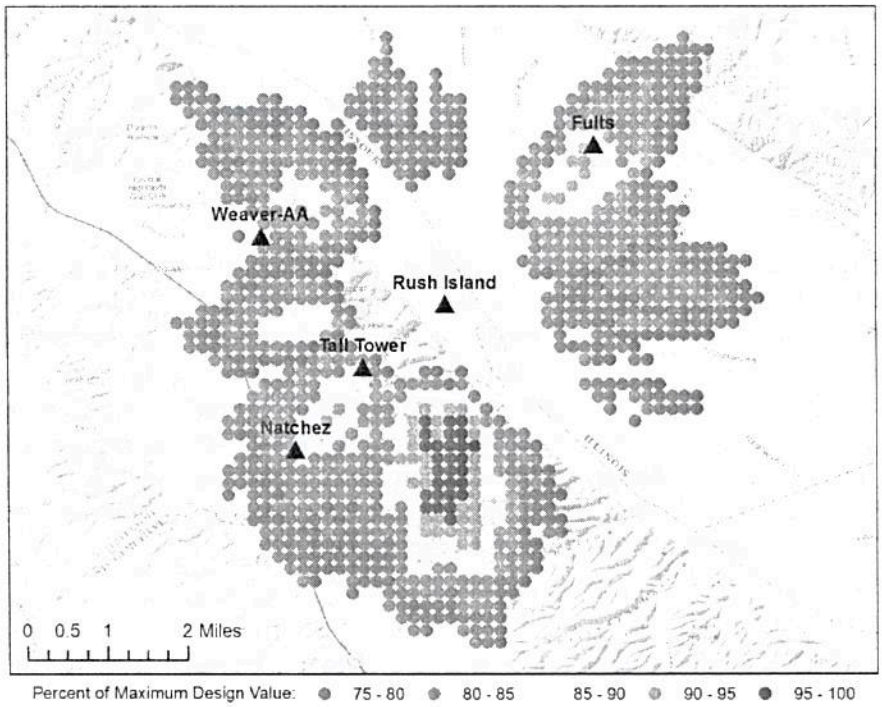

Figure 2. Receptors with modeled design values ≥75 percent of the maximum modeled design value.

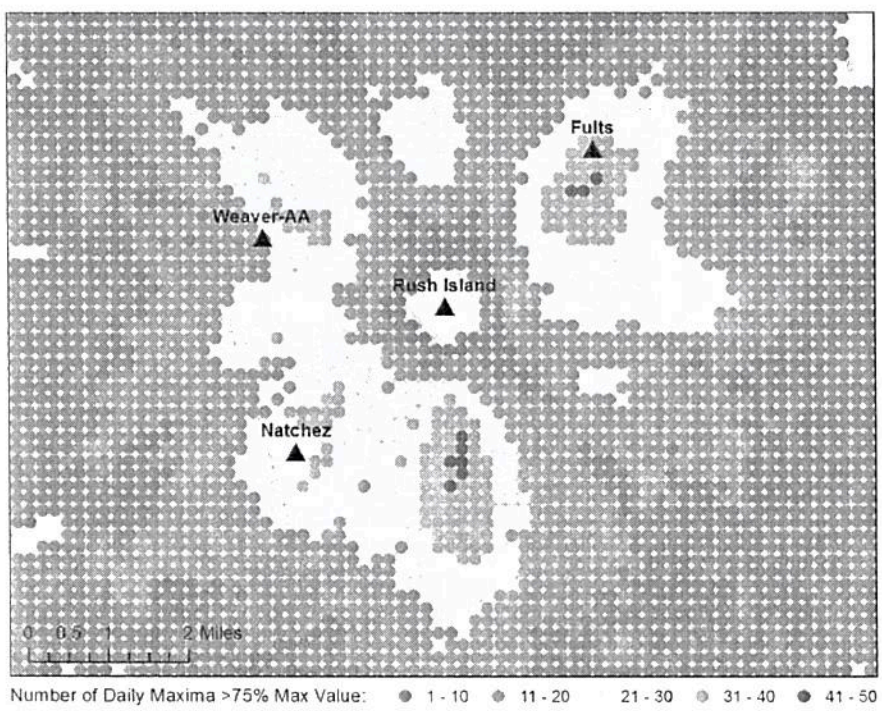

Figure 3. Number of maximum daily 1-hour concentrations ≥75 percent of the maximum modeled design value.

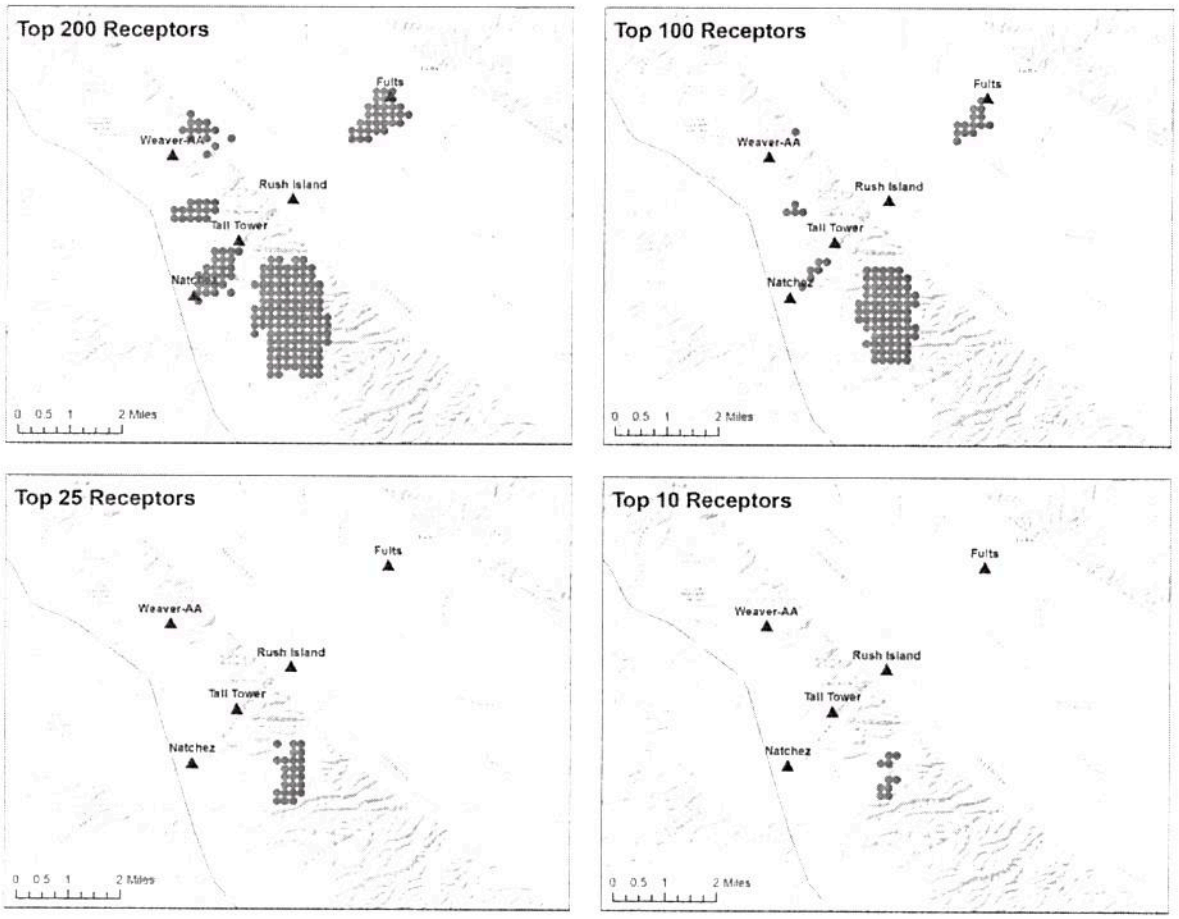

Figure 4. Receptors with the top 200, 100, 25, and 10 modeled design values.

Figures 1 through 4 all reveal a strikingly similar pattern regarding the areas where peak 1-hour SO_2 concentrations are expected to occur around the Rush Island Energy Center. There is a large area due south of the plant where modeled design values are the highest (in excess of 95 percent of the maximum modeled design value), where modeled maximum daily 1-hour concentrations frequently exceeded 75 percent of the maximum modeled design value, and where over half of the top 200 receptors (including all of the top 25 and three quarters of the top 100) are located. There are also four other areas where modeled design values are slightly lower but still very high (in excess of 85 percent of the maximum modeled design value), where modeled maximum daily 1-hour concentrations frequently exceeded 75 percent of the maximum modeled design value, and where the rest of the top 200 receptors are located. These four areas, located northeast, northwest, west, and southwest of the plant, plus the area south of the plant where modeled design values are the highest, are where Ameren's modeling predicts peak 1-hour SO_2 concentrations are expected to occur. Monitoring stations located in these areas would have the greatest chance of identifying peak SO_2 concentrations in ambient air, which is the primary objective of source-oriented monitoring and an absolute necessity when monitoring to assess

compliance with the NAAQS. However, none of Ameren's proposed monitoring stations is located in any of these areas of highest expected concentrations.

The most glaring omission is that there is no proposed monitoring station in the large area of highest expected concentrations south of the plant. This omission renders the proposed monitoring network inadequate for its intended purpose of assessing compliance with the NAAQS because a) NAAQS violations are most likely to occur in this area, and b) violations could occur in this area even when concentrations are below the NAAQS in other high concentration areas, given that the modeling predicts lower SO_2 concentrations in those areas. Ameren's Monitoring Stations Analysis claims that this area is "not accessible" because it hosts an industrial plant (Holcim). The Analysis does not indicate whether Ameren sought Holcim's permission to site a monitor on the Holcim property, and does not delineate the Holcim property boundary in terms of the modeling results. In other words, it does not document the claim that this large area of maximum expected concentrations is inaccessible for monitoring. Nor does it evaluate the nearest non-Holcim site that might be available.

While we understand that the Consent Agreement between DNR and Ameren calls for monitoring, it requires that such monitoring "represents ambient air quality in areas of maximum SO_2 impact from the Rush Island Energy Center." If no monitoring site is in fact accessible in this large area of the very highest expected concentrations, then the proposed monitoring network will not fulfill Ameren's obligation under the Consent Agreement. Instead, DNR should employ modeling, which provides 360-degree coverage and can predict concentrations at otherwise-inaccessible locations, to ensure that SO_2 emissions from the Rush Island plant do not cause or contribute to NAAQS exceedances either inside or outside of the Jefferson County nonattainment area.

Furthermore, two of the proposed monitoring stations – Fults and Natchez – are located near but outside of areas of modeled peak concentration/high frequency instead of near the center of such areas, where concentrations are expected to be higher. The third proposed station – Weaver-AA – is located entirely outside of modeled peak concentration/high frequency areas. Figure 5 shows the locations of the proposed monitoring stations on a hybrid basemap comprised of Figures 1 (modeled design values) and 2 (receptors with modeled design values $\geq$75 percent of the maximum design value). Receptors that are among the 200 with the highest modeled design values are outlined for reference. All three monitoring stations could easily be sited in areas where higher 1-hour SO_2 concentrations are expected to occur with greater frequency, thereby increasing their chances of detecting any NAAQS exceedances that might occur around the Rush Island Energy Center. As discussed below, we urge DNR to consider these proposed optimized locations in lieu of Ameren's proposed Fults, Natchez, and Weaver-AA locations.

Fults – Of the three proposed monitoring stations, the Fults monitoring station is closest to an area where peak 1-hour SO_2 concentrations are expected to occur. However, moving the monitor less than one kilometer southwest of its current location would move it from an area with modeled design values in the 120-130 ug/m^3 range to an area with modeled design values in the 130-140 ug/m^3 range and place it near the center of a small group of receptors with modeled design values equal to 90-95 percent of the maximum modeled design value (the receptors

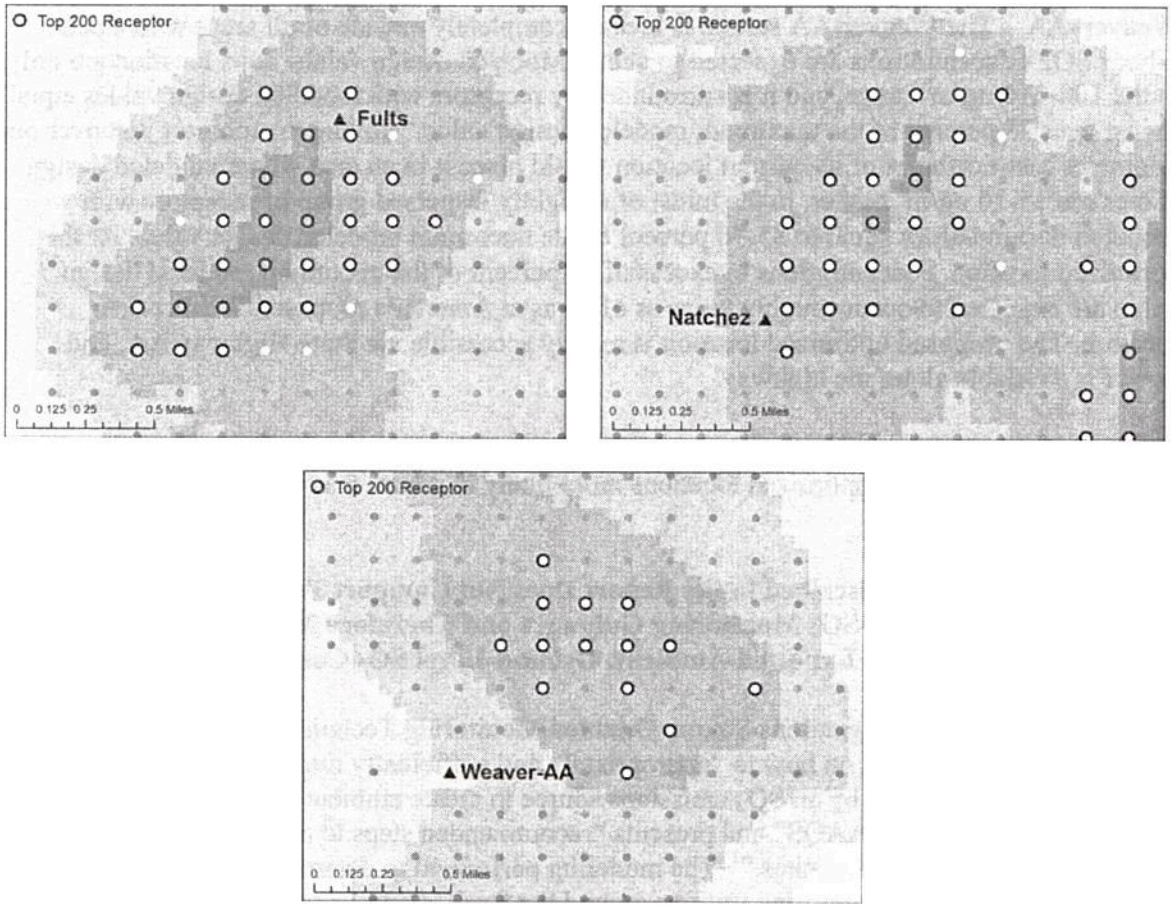

Figure 5. Modeled design values, receptors with design values ≥75 percent of the maximum modeled design value, and proposed monitoring station locations.

surrounding its current location generally have modeled design values equal to 85-90 percent of the maximum modeled design value). The entire area is floodplain/agricultural and Ivy Road, oriented northeast-southwest, runs through the middle of it, making the proposed optimized location as accessible as Ameren's proposed location and equally easy to provide power to.

Natchez – The Natchez monitoring station is outside/on the outer edge of an area where peak 1-hour SO_2 concentrations are expected to occur. Moving it approximately one kilometer northeast of its current location would move it from an area with modeled design values in the 120-130 ug/m^3 range to an area with modeled design values in the 130-140 ug/m^3 range, and place it between a pair of receptors with modeled design values equal to 90-95 percent of the maximum modeled design value (the receptors surrounding its current location have modeled design values equal to 80-90 percent of the maximum modeled design value). It would also move it to an area where higher concentrations are expected to occur with slightly greater frequency. The proposed optimized location is accessible via transmission right of way, and power is available along Dubois Creek Road to the south-southwest.

Weaver-AA – The Weaver-AA station is located completely outside of all areas where peak 1-hour SO2 concentrations are expected to occur. Modeled design values at its location are only in the 100-110 ug/m^3 range, and it is surrounded by receptors with modeled design values equal to just over 75 percent of the maximum modeled design value. Moving the monitor just over one kilometer east-northeast of its current location would place it in an area where modeled design values are 15-20 ug/m^3 higher, in the midst of a slightly dispersed group of receptors with modeled design values equal to 85-90 percent of the maximum modeled design value. At this optimized location, concentrations in excess of 75 percent of the maximum modeled design value are expected to occur roughly twice as often as at Ameren's proposed Weaver-AA location. The proposed optimized location is readily accessible via State Highway AA, and power is available along the highway.

Figure 6 compares the locations of Ameren's proposed Fults, Natchez, and Weaver-AA monitoring stations with optimized locations more likely to record maximum SO_2 concentrations in the area.

II. The Modeling Described in the Report Does Not Comport With EPA's Source-Oriented SO_2 Monitoring Guidance and Therefore May Not Correctly Identify Areas of Expected Ambient, Ground-Level SO_2 Concentration Maxima

EPA's SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document (TAD) provides guidance on how to "appropriately and sufficiently monitor ambient air in areas proximate to or impacted by an SO_2 emissions source to create ambient monitoring data for comparison to the SO_2 NAAQS" and presents "recommended steps to aid in identifying source-oriented SO_2 monitor sites."[1] The modeling performed to determine the locations of the proposed ambient SO_2 monitoring stations around the Rush Island Energy Center fails to adhere to the TAD in two important respects: 1) it does not use hourly emission rates, which are readily available for Rush Island's boilers from EPA's online Air Markets Program Data tool; and 2) it does not include nearby sources that may contribute significantly to ambient SO_2 concentrations in the vicinity of the plant and therefore should be included in the modeling.

EPA suggests using hourly emissions when available in order to represent the variability of actual emissions as accurately as possible,[2] which is important given the short-term nature of the SO_2 NAAQS. However, instead of using readily-available hourly emissions as recommended by EPA's monitoring TAD, Ameren's modeling uses constant emission rates for Rush Island's boilers. The consequence of using constant rather than hourly emission rates is that the effects of the interaction between hourly emissions and hourly variations in meteorological parameters are not captured by the model, so that the predicted areas of peak concentration are primarily a function of the meteorology used. For example, if peak hourly emissions coincide with times when strong winds blow from a direction other than the prevailing wind direction, a model that uses hourly emission rates might predict peak concentrations in different areas than the same

[1] U.S. EPA, SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, Dec. 2013 Draft, at 2, available at http://epa.gov/airquality/sulfurdioxide/pdfs/SO2MonitoringTAD.pdf.

[2] *Id.* at 11, referencing U.S. EPA, SO_2 NAAQS Designations Modeling Technical Assistance Document, Dec. 2013 Draft, at 10, available at http://epa.gov/airquality/sulfurdioxide/pdfs/SO2ModelingTAD.pdf.

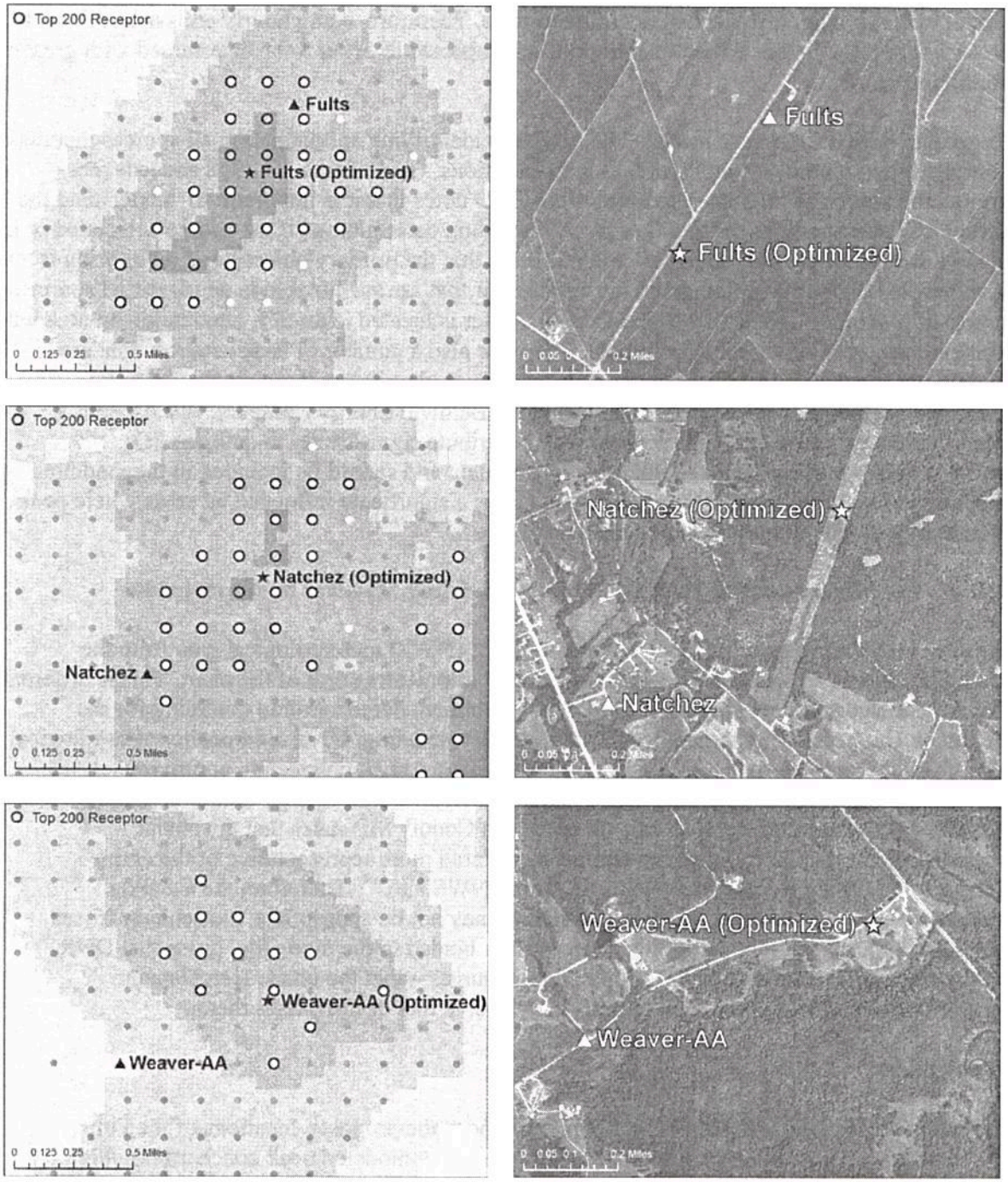

Figure 6. Current and optimized locations of the Fults, Natchez, and Weaver-AA monitoring stations

model would predict using constant emission rates. Therefore, using hourly emissions allows the areas where peak 1-hour SO_2 concentrations are expected to occur to be determined with greater confidence.

Regarding which sources to model, EPA suggests identifying and including all sources that may contribute significantly to ambient SO_2 concentrations – and thus to NAAQS exceedances – around the source of interest. The monitoring TAD notes that it is important to "understand the setting and surroundings of the SO_2 source" including determining "if the source is isolated or in an area with multiple SO_2 sources," and it affirms that the primary objective of monitoring is "to identify peak SO_2 concentrations in the ambient air that are attributable to an identified source *or group of sources.*"[3] The Rush Island Energy Center is located in an SO_2 nonattainment area with numerous sources of varying magnitude. There are also a number of larger sources that are nearby but just outside of the nonattainment area, including River Cement, St. Gobain Containers, Holcim, Mississippi Lime, Dynegy's Baldwin Energy Complex, and Ameren's Meramec Energy Center. These sources may contribute significantly to ambient SO_2 concentrations in the vicinity of the Rush Island plant and should be included in the modeling unless it can be demonstrated that they do not have a significant influence on areas where peak 1-hour SO_2 concentrations are expected to occur.

III. The Meteorological Data Used in the Modeling May Not be Appropriate

Ameren's modeling uses National Weather Service (NWS) meteorological data from the Cahokia, Illinois airport located approximately 50 kilometers north of the plant. This is different from the meteorological data DNR used in its attainment demonstration modeling for the Jefferson County SO_2 nonattainment SIP. In its SIP modeling, DNR used onsite meteorological data from the now-closed Doe Run primary lead smelter in Herculaneum, approximately 18 kilometers northwest of the Rush Island plant. The Rush Island Energy Center is in the Jefferson County SO_2 nonattainment area, and the Jefferson County SIP states that the onsite meteorological data from Herculaneum is "considered more representative of the entire [nonattainment] area compared to a more distant NWS site."[4] Therefore, the Cahokia meteorological data used in Ameren's modeling may not be appropriate, particularly if – as suggested above – other nearby SO_2 sources are included in the modeling, given that DNR determined – based on the distribution of these sources – that the onsite Herculaneum meteorological data is more representative of the area that encompasses them.

Conclusion

Based on the modeling described in Ameren's report, the proposed locations of the Fults, Natchez, and Weaver-AA monitoring stations are not in modeled peak concentration/high frequency areas. Furthermore, Ameren has not proposed a monitoring station in the highest concentration area due south of the Rush Island Energy Center, citing the claimed but not

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[3] *Id.* at 2, 4 (emphasis added).

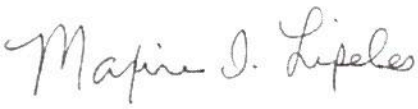
[4] DNR, Nonattainment Plan for the 2010 1-Hour Sulfur Dioxide National Ambient Air Quality Standard, Jefferson County Sulfur Dioxide Nonattainment Area, May 28, 2015, at 26.

documented inaccessibility of potential monitoring sites in that area. The absence of a monitor in this large area of expected maximum concentration calls into question whether the proposed SO_2 monitoring network is an appropriate means of assessing compliance with the NAAQS in the area around the plant.

Ameren's proposed monitoring network does not fulfill its requirement under the Consent Agreement to install a monitoring network designed to record maximum expected SO_2 concentrations in the vicinity of the Rush Island plant. Nor is it designed to achieve Ameren's purported goal of obtaining "a good quality data set with representative SO_2 measurements and meteorological information"[5] or DNR's stated goal "to true-up modeling results further away from the Mott Street monitor … to confirm our assessment that the nonattainment area is in compliance with the 1-hour SO2 standard farther away from the violating monitor."[6]

We urge DNR to reject the proposed monitoring sites and require Ameren to add a monitoring station in the highest concentration area due south of the plant as well as to relocate the proposed Fults, Natchez, and Weaver-AA monitoring stations to the optimized locations shown in Figure 5. We also urge DNR to require Ameren to 1) rerun the air dispersion model described in the report using Rush Island's actual hourly emissions; 2) evaluate the effects of nearby interactive sources (including, at a minimum, River Cement, St. Gobain Containers, Holcim, Mississippi Lime, Dynegy's Baldwin Energy Complex, and Ameren's Meramec Energy Center) on modeled peak concentration/high frequency areas; and 3) evaluate the appropriateness of using meteorological data from the Cahokia, Illinois airport instead of Doe Run Herculaneum given DNR's determination that the latter is more representative of the modeled area.[7] We further urge DNR to require any necessary adjustments to the proposed monitoring network based on the results of these analyses.

Respectfully submitted,



Maxine I. Lipeles, J.D.
Ken Miller, P.G.
Interdisciplinary Environmental Clinic
Washington University School of Law

On behalf of the Sierra Club

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[5] DNR, Comments and Responses on Proposed Revision to Missouri State Implementation Plan – Nonattainment Plan for the 2010 1-Hour Sulfur Dioxide National Ambient Air Quality Standard – Jefferson County Sulfur Dioxide Nonattainment Area, Comment #21, p. 10, available at http://dnr.mo.gov/env/apcp/docs/comments-and-responses-jeffco.pdf.

[6] *Id.*, Response to Comment #4, p. 3.

[7] This analysis should consider and make use of the corrected Herculaneum meteorological data set processed in AERMET with the Bulk Richardson Number option invoked.

Cc: Rebecca Weber, Director, Air & Waste Management Division, EPA Region 7
Josh Tapp, Chief, Air Planning & Development Branch, EPA Region 7
Kyra Moore, Director, Air Pollution Control Program, DNR
Wendy Vit, Chief, Air Quality Planning Section, Air Pollution Control Program, DNR

Washington University in St. Louis

SCHOOL OF LAW

Interdisciplinary Environmental Clinic

August 11, 2015

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Re: Supplemental Comments on 2015 Monitoring Network Plan

Dear Mr. Hall:

On behalf of the Sierra Club, we submit these supplemental comments on the Missouri Department of Natural Resources' ("DNR") proposed 2015 Monitoring Network Plan.[1] We previously submitted comments on the plan on July 20, 2015, urging DNR to refrain from proposing new sulfur dioxide ("SO_2") monitoring sites near Ameren's Labadie power plant until EPA completes an area designation for the plant by July 2016.

These supplemental comments are based on new information provided in DNR's proposed 2010 1-Hour Sulfur Dioxide Standard, Proposed Options for Area Boundary Recommendations, July 2016 Designations.[2] This information includes new modeling of Labadie's emissions performed by DNR, as well as new wind climatology data from a recently-installed meteorological monitoring station near the plant. The new DNR modeling confirms that at least one of the two new Labadie SO_2 monitoring sites is unlikely to capture maximum ambient SO_2 concentrations because it is not located in an area where peak SO_2 concentrations are expected to occur. The new wind climatology data calls into doubt the siting of the other Labadie SO_2 monitoring site as well and suggests that neither monitor may be appropriately sited for use in future NAAQS compliance evaluations. This further demonstrates why DNR should wait until EPA completes an area designation for Labadie before proposing new SO_2 monitoring sites near the plant.

I. New Modeling By DNR Confirms That The Valley Monitoring Site Is Not Located In An Area Where Peak SO_2 Concentrations Are Expected To Occur.

As described in our July 20, 2015 comments on the proposed 2015 Monitoring Network Plan, Ameren's modeling of Labadie's emissions for purposes of locating the new monitoring sites

[1] DNR, 2015 Monitoring Network Plan, June 12, 2015, available at http://dnr.mo.gov/env/apcp/docs/2015-monitoring-network-plan.pdf.

[2] DNR, 2010 1-Hour Sulfur Dioxide Standard, Proposed Options For Area Boundary Recommendations, July 2016 Designations, July 24, 2015 ("2016 Area Boundary Recommendations"), available at http://dnr.mo.gov/env/apcp/docs/2010-so2-options-for-july-2016-desig-aug-27-2015-pub-hrg.pdf.

identified three distinct areas where peak SO_2 concentrations are expected to occur. These areas, demarcated by orange and red receptors, are located northwest, northeast, and southeast of the plant and are shown in Figure 1 below. However, only one of the two new monitoring sites – the Northwest site – is located in a peak concentration area as modeled by Ameren. The Valley monitoring site is located between the other two Ameren-modeled peak concentration areas, in an area where the modeled concentration is only about 80 percent of the maximum concentration predicted by Ameren's model.

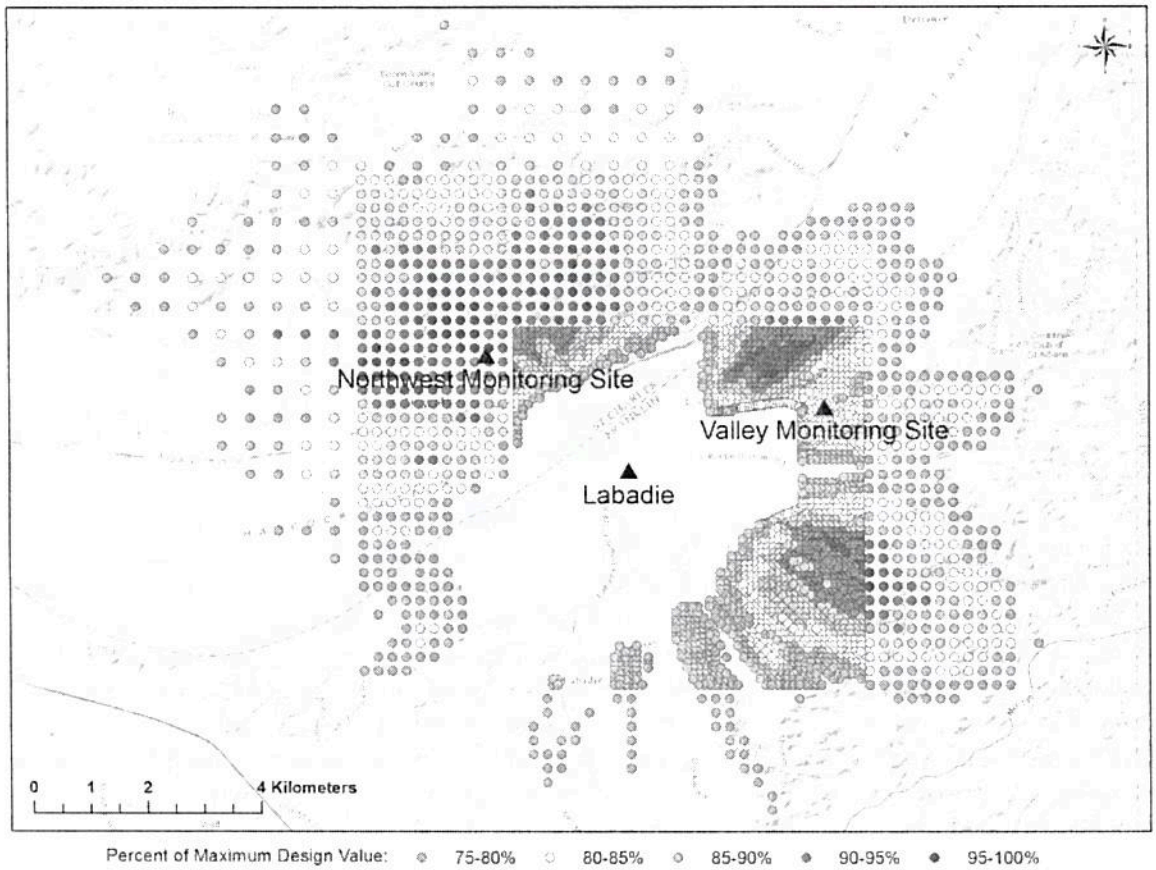

Figure 1. Expected peak SO_2 concentration areas per Ameren's modeling.

Moreover, Ameren's modeling was inconsistent with EPA guidance. In more detailed comments we submitted to DNR on April 13, 2015 critiquing Ameren's proposed monitoring site locations,[3] we noted that Ameren had failed to adhere to EPA's source-oriented SO_2 monitoring guidance in its modeling of the plant's emissions and therefore may have failed to correctly identify areas where peak concentrations are expected to occur. In particular, Ameren's modeling

[3] These comments were attached to and incorporated by reference into our July 20 comments on the 2015 Monitoring Network Plan.

used constant emission rates instead of hourly emission rates as recommended by EPA.[4] Using hourly emission rates, which are readily available from EPA's online Air Markets Program Data tool, allows areas where peak SO_2 concentrations are expected to occur to be determined with greater confidence because the interaction between hourly emissions and hourly variations in meteorological parameters is accounted for by the model. This interaction is ignored when constant emission rates are used.

In its recently-proposed 2010 1-Hour Sulfur Dioxide Standard, Proposed Options for Area Boundary Recommendations, July 2016 Designations ("2016 Area Boundary Recommendations"), DNR describes the modeling of Labadie's emissions that it performed for purposes of making an SO_2 area designation and boundary recommendation to EPA for the area around the plant. DNR's modeling is identical to Ameren's in most respects and uses meteorological data from the same National Weather Service site (Jefferson City Memorial Airport in Jefferson City, MO).[5] However, unlike Ameren, DNR used hourly emission rates per EPA guidance in its modeling. The peak concentration areas, demarcated by orange and red receptors, predicted by DNR's model are shown in Figure 2 (see next page). DNR's receptors violating the 2010 1-hour SO_2 NAAQS are shown in Figure 3 (see page 5).

DNR's modeling, as illustrated by Figures 2 and 3, confirms that the Valley monitoring site is not located in an area where peak SO_2 concentrations are expected to occur. To the contrary, the Valley site is in an area where the modeled concentration is less than 75 percent of the maximum concentration predicted by DNR's model. DNR's modeling also confirms that there is an expected peak concentration area southeast of the plant with considerably higher modeled SO_2 design values than at the Valley monitoring site, yet with no monitor. DNR's model predicts NAAQS exceedances in this other area, but not at the Valley site.

In summary, DNR's modeling – which, unlike Ameren's, adhered to EPA guidance as to the use of variable hourly emission rates – makes clear that the Valley site is not an appropriate location for an SO_2 monitor.

II. New Wind Climatology Data From the Valley Monitoring Site Demonstrates The Need To Collect Additional On-Site Meteorological Data Before DNR Proposes New SO_2 Monitors Near The Labadie Plant.

The Valley monitoring site, which began operating in April, includes both an ambient SO_2 monitor and a meteorological monitoring station that monitors various meteorological parameters including horizontal wind speed and direction. Preliminary data from the Valley meteorological monitoring station for the period April 22 – July 13, 2015 is included in Appendix F of DNR's 2016 Area Boundary Recommendations. Analysis of this data suggests

[4] U.S. EPA, SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, Dec. 2013 Draft, at 11, referencing U.S. EPA, SO2 NAAQS Designations Modeling Technical Assistance Document, Dec. 2013 Draft, at 10, available at http://epa.gov/airquality/sulfurdioxide/pdfs/SO2ModelingTAD.pdf.

[5] DNR's modeling includes an emergency diesel generator at Labadie and a pair of interactive sources south of the plant that were not included in Ameren's modeling. However, these sources have very low emissions and do not contribute significantly to modeled concentrations near the plant.

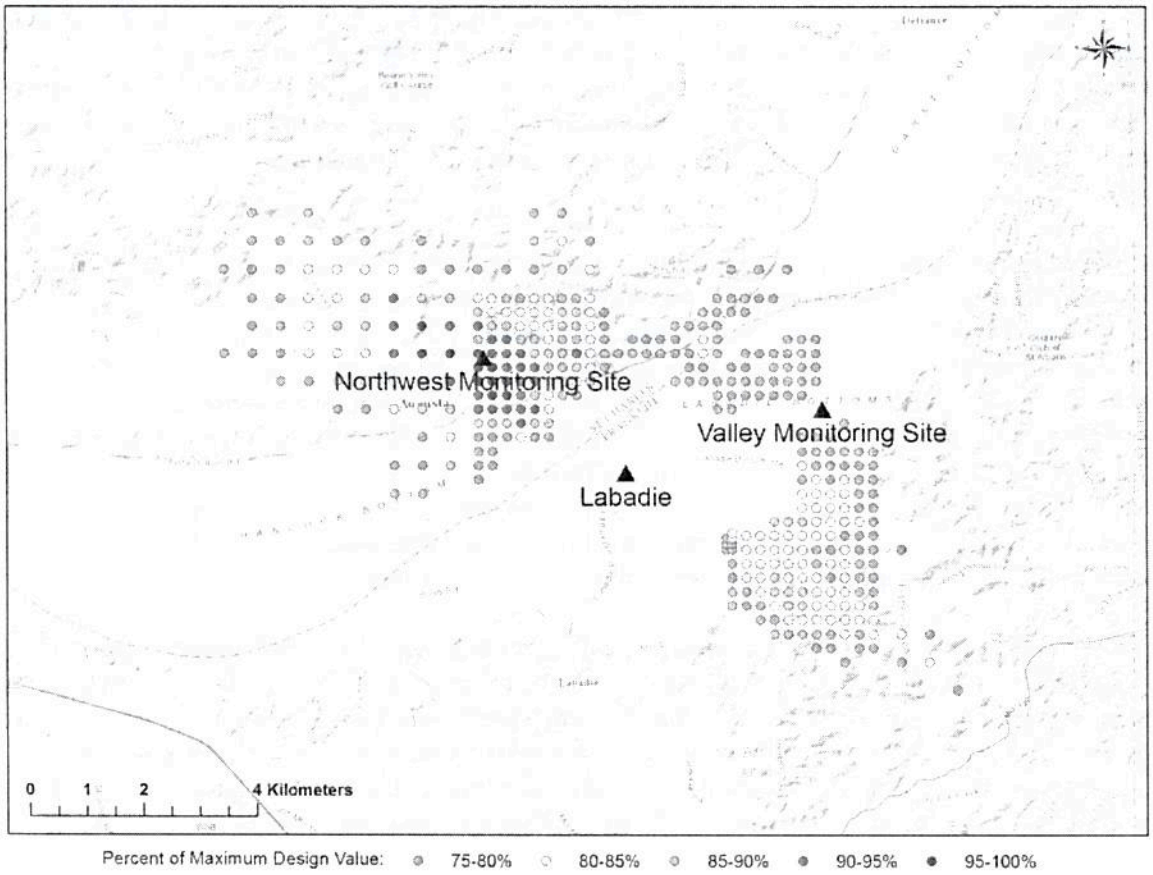

Figure 2. Expected peak SO_2 concentration areas per DNR's modeling.

that the surface meteorological data used in both Ameren's and DNR's modeling of Labadie's emissions may not be representative of the area.

Ameren and DNR both used surface meteorological data from the Jefferson City Memorial Airport ("KJEF"), located approximately 115 kilometers west of Labadie, in their modeling of the plant's emissions instead of data from the much closer Spirit of St. Louis Airport ("KSUS"), located just 19 kilometers northeast of the plant. In making the decision to use KJEF instead of KSUS surface meteorological data, DNR relied exclusively on a comparison of surface characteristics (surface roughness, Bowen ratio, and albedo) at each airport to surface conditions at Labadie. Despite stating in its 2016 Area Boundary Recommendations that "other meteorological parameters, including wind speed and direction as influenced by terrain, must also be used when choosing a representative meteorological site,"[6] DNR did not compare available wind climatology data from the Valley monitoring site to contemporaneous wind climatology data from KJEF and KSUS to see which airport's winds are most similar to those at Labadie.

[6] 2016 Area Boundary Recommendations at D-2.

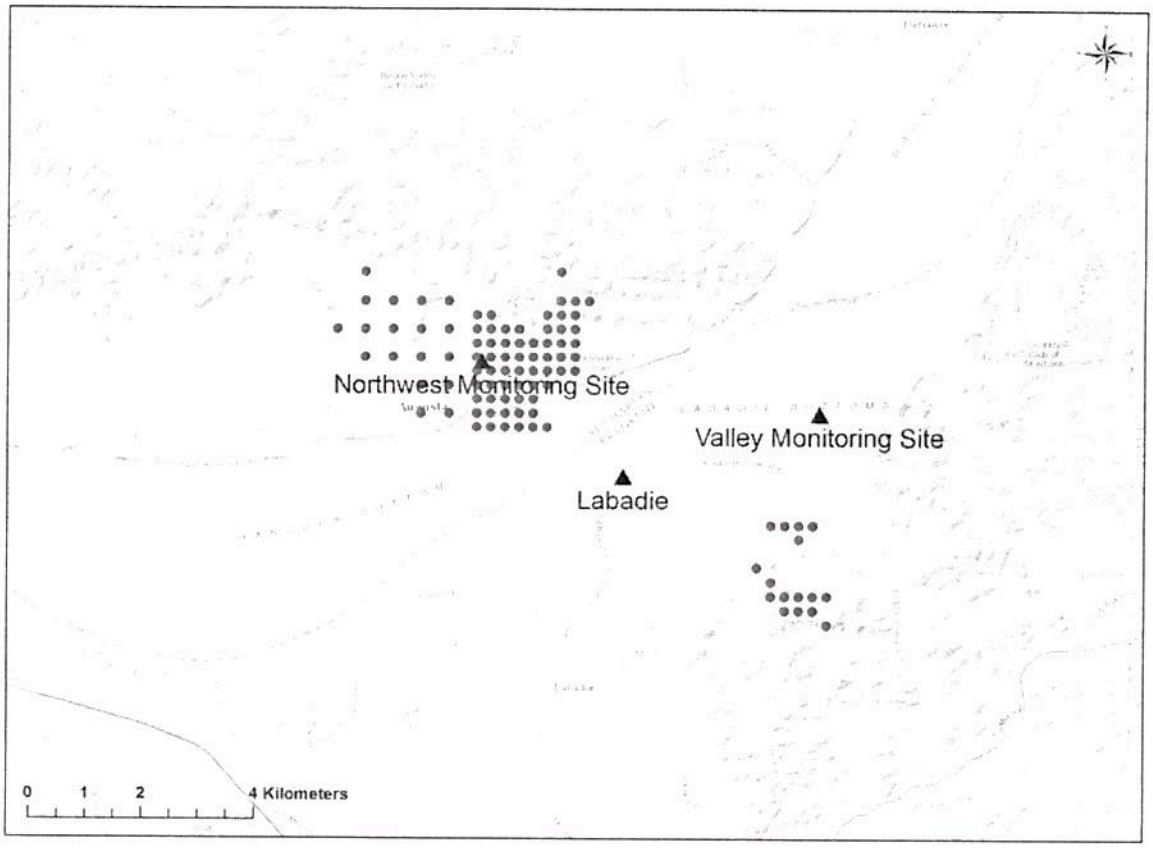

Figure 3. DNR receptors violating the 2010 1-hour SO_2 NAAQS.

Figures 4 and 5 (see next page) show the wind rose for the Valley monitoring site compared to the wind roses for KSUS and KJEF, respectively, for the period April 22 – July 13, 2015. As illustrated by Figures 4 and 5, during the first few months the Valley meteorological monitoring station was in operation, the most frequent winds at both Labadie and KSUS were from the south, south-southwest, and southwest, whereas the most frequent winds at KJEF were from the east and east-southeast. Furthermore, the strongest winds at both Labadie and KSUS were generally from the predominant wind directions whereas the strongest winds at KJEF were from the south and south-southwest, orthogonal to the predominant wind directions.

Therefore, the preliminary meteorological data from the Labadie area suggest that the winds at Labadie may be more similar to the winds at KSUS than the winds at KJEF, which in turn suggests that KSUS surface meteorological data may be more representative of the area and more appropriate for modeling Labadie's emissions than KJEF data.

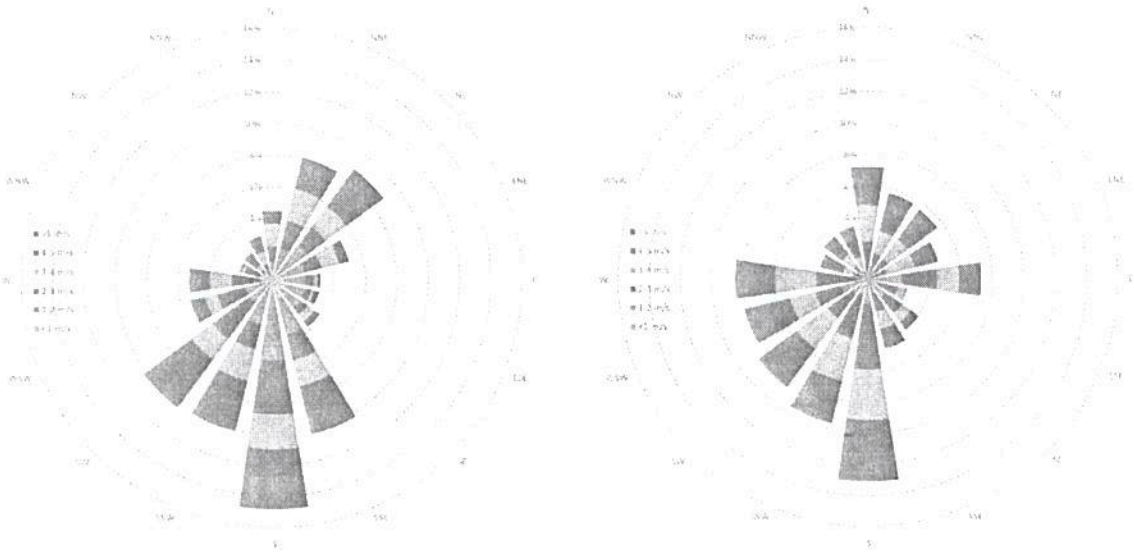

Figure 4. Valley monitoring site (left) and KSUS (right) wind rose comparison.

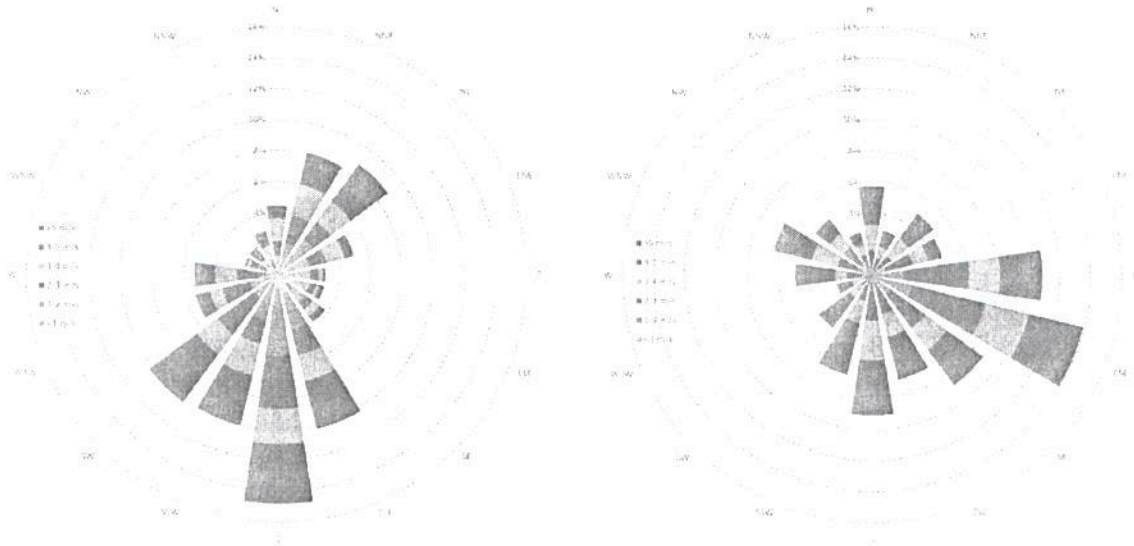

Figure 5. Valley monitoring site (left) and KJEF (right) wind rose comparison.

Figure 6 (see next page) shows peak concentration areas, demarcated by orange and red receptors, predicted by DNR's model when KSUS surface meteorological data is used instead of KJEF data. The results are striking; *if KSUS data is in fact more representative of the area than KJEF data, then neither the Valley monitoring site nor the Northwest monitoring site is located in an area where peak SO_2 concentrations are expected to occur and neither is appropriately sited for use in future NAAQS compliance evaluations.*

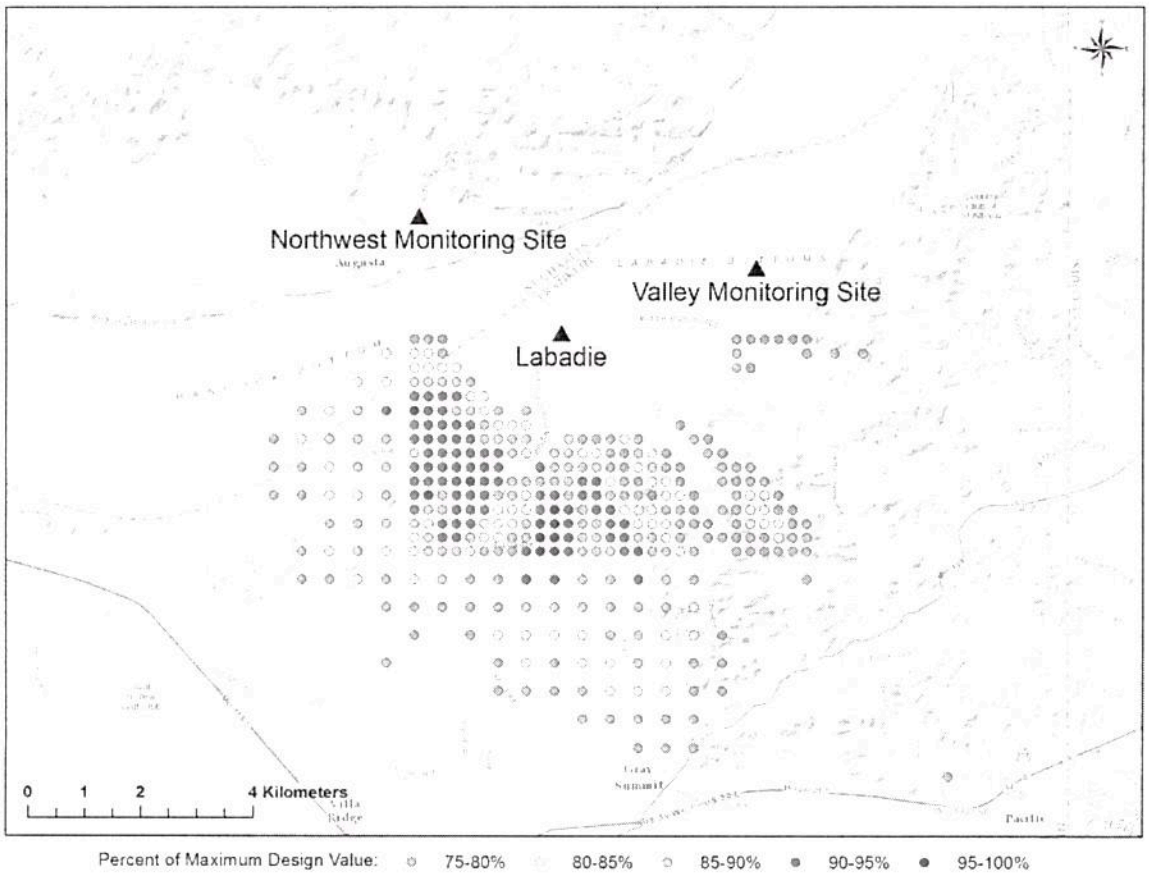

Figure 6. Expected peak SO_2 concentration areas per DNR's modeling using KSUS instead of KJEF surface meteorological data.

We recognize that the wind climatology data from the Valley meteorological monitoring site included in Appendix F of DNR's 2016 Area Boundary Recommendations is not yet quality assured and that, given the short-term nature of the data, it is by no means certain that the winds at Labadie will prove to be more similar to the winds at KSUS than at KJEF over the long term. However, this only demonstrates further why DNR should wait until EPA completes an area designation for Labadie before proposing new SO_2 monitoring sites near the plant. EPA must make a final area designation for the plant by July 2016.[7] By that time, DNR will have over a year of on-site meteorological data from the Valley monitoring site and a second meteorological monitoring station at the nearby Osage Ridge monitoring site,[8] which it can then use to model Labadie's emissions for monitor-siting purposes or to make a more definitive determination regarding which airport site has the most representative meteorological data and should be used in such modeling.

[7] *Sierra Club v. Gina McCarthy*, No. 3:13-cv-3953-SI (Consent Decree, March 2, 2015).
[8] No data from the Osage Ridge site was included in the 2016 Area Boundary Recommendations so it is unknown how winds at the site compare to winds at the Valley monitoring site, KSUS, or KJEF.

Conclusion

For the reasons set forth above and in our July 20 comments on the 2015 Monitoring Network Plan, DNR should withdraw both of the new Labadie SO_2 monitoring sites pending the completion of the Labadie area designation process, the collection of additional on-site meteorological data from the Valley and Osage Ridge meteorological monitoring stations, and the performance of additional modeling using the most representative surface meteorological data to determine the areas of expected peak ambient SO_2 concentrations around the plant. Furthermore, EPA should not approve the 2015 Monitoring Network Plan with the inclusion of the new Labadie SO_2 monitoring sites and should reject it pending their withdrawal by DNR.

Sincerely yours,

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Josh Tapp, Chief, Air Planning & Development Branch, EPA Region 7
Kyra Moore, Director, Air Pollution Control Program, DNR
Wendy Vit, Chief, Air Quality Planning Section, Air Pollution Control Program, DNR

Ameren Labadie Plant

Labadie, Missouri

Evaluation of Compliance with the 1-hour NAAQS for SO_2

September 3, 2015

Conducted by:

Steven Klafka, P.E., BCEE

Wingra Engineering, S.C.

Madison, Wisconsin

Exhibit4

1. Introduction

Wingra Engineering, S.C. was hired by Sierra Club to conduct an air modeling impact analysis to help the U.S. Environmental Protection Agency (USEPA) and state and local air agencies identify facilities that are likely causing exceedances of the 1-hour sulfur dioxide (SO_2) national ambient air quality standard (NAAQS). This document describes the results and procedures for an evaluation conducted for the Ameren Labadie Plant located in Labadie, Missouri.

To ensure the modeling analysis reflected the cumulative concentration of SO_2 emissions, it included emissions from the following additional sources of SO_2 emissions located within 50 kilometers of the Ameren Labadie Plant:

- Purina Animal Nutrition Center - Gray Summit, Missouri
- N.B. West Contracting Company Inc.NC – Pacific, Missouri

The dispersion modeling analysis predicted ambient air concentrations for comparison with the 1-hour SO_2 NAAQS. The modeling was performed using the most recent version of AERMOD, AERMET, and AERMINUTE, with data provided to Sierra Club by regulatory air agencies or obtained through other publicly-available sources as documented below. The analysis was conducted in adherence to all available USEPA guidance for evaluating source impacts on attainment of the 1-hour SO_2 NAAQS via aerial dispersion modeling, including the AERMOD Implementation Guide; USEPA's Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010; modeling guidance promulgated by USEPA in Appendix W to 40 CFR Part 51; USEPA's March 2011 Modeling Guidance for SO_2 NAAQS Designations; [1] and USEPA's December 2013 SO_2 NAAQS Designations Technical Assistance Document.[2]

2. Compliance with the 1-hour SO_2 NAAQS

2.1 1-hour SO_2 NAAQS

The 1-hour SO_2 NAAQS takes the form of a three-year average of the 99th percentile of the annual distribution of daily maximum 1-hour concentrations, which cannot exceed 75 parts per billion (ppb).[3] Compliance with this standard was verified using USEPA's AERMOD air dispersion model, which produces air concentrations in units of $\mu g/m^3$. The 1-hour SO_2 NAAQS of 75 ppb equals 196.2 $\mu g/m^3$, and this is the value used for determining whether modeled impacts exceed the

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[1] http://www.epa.gov/scram001/so2_modeling_guidance.htm
[2] http://www.epa.gov/oaqps001/sulfurdioxide/pdfs/SO2ModelingTAD.pdf
[3] USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010.

NAAQS.[4] The 99th percentile of the annual distribution of daily maximum 1-hour concentrations corresponds to the fourth-highest value at each receptor for a given year.

2.2 Modeling Results

Model results for all sources included in the SO_2 analysis are summarized in Table 1. Results are provided for Labadie alone and for all sources combined.

Modeling results for Ameren Labadie Plant and the other two facilities are summarized in Table 1. It was determined that based on either current allowable emissions or measured actual emissions, the Ameren Labadie Plant is estimated to create downwind SO_2 concentrations which exceed the 1-hour NAAQS.

More specifically, the modeling results presented in Table 1, show exceedances of the NAAQS by the plant's allowable and actual emissions. "Allowable" is the peak emission rate from each unit as approved by the current air quality operation permit for the facility. "Actual" are the measured emissions for each hour between January 1, 2012 and December 31, 2014 as taken from USEPA *Air Markets Program Data*.[5]

Air quality impacts in Missouri are based on a background concentration of 23.5 $\mu g/m^3$. This is the 2011-13 design value for Monroe County, Missouri – the lowest measured background concentration in the state. This is the most recently available design value. See Section 5 for further discussion of the background concentrations used for this analysis.

Table 1 - SO_2 Modeling Results for Ameren Labadie Plant Modeling Analysis

Emission Rates	Facility	99th Percentile 1-hour Daily Maximum ($\mu g/m^3$)				Complies with NAAQS?
		Impact	Background	Total	NAAQS	
Allowable	Labadie	2,559.7	23.5	2,583.2	196.2	No
Actual	Labadie	212.2	23.5	235.7	196.2	No
Actual	All	212.2	23.5	235.7	196.2	No

[4] The ppb to $\mu g/m^3$ conversion is found in the source code to AERMOD v. 14134, subroutine Modules. The conversion calculation is 75/0.3823 = 196.2 $\mu g/m^3$.
[5] http://ampd.epa.gov/ampd/

The emissions used for the modeling analysis are summarized in Table 2.

Table 2 - Modeled SO_2 Emissions [6]

Stack ID	Unit ID	Allowable Emissions 1-hour Average (lbs/hr)
S01	B1	29,678.4
S02	B2	29,678.4
S03	B3	29,313.6
S04	B4	29,313.6
Stack Total	All Units	117,984.0

Based on the modeling results, Table 3 provides the emission reductions from current allowable rates necessary to achieve compliance with the 1-hour NAAQS. This assumes a one-hour averaging period for the emission rate and that the emission rate is binding at all times. However, given the conservative aspects of this modeling protocol, it is extremely likely that this limit is too high to protect the NAAQS. For example, startup or shutdown periods were not evaluated. During these periods, decreased gas velocities and temperatures may lead to greater ambient impacts at ground level. Further, the hypothetical emission limitation in Table 3 would allow Ameren Labadie Plant to consume the entire NAAQS, leaving little to no room for any other source of SO_2 in the area. No margin of safety has been included in the hypothetical emission limitation.

Table 3 - Required Emission Reductions from Ameren Labadie Plant for Compliance with the 1-hour NAAQS for SO_2

Acceptable Impact (NAAQS - Background) 99th Percentile 1-hour Daily Max ($\mu g/m^3$)	Required Total Facility Reduction Based on Allowable Emissions (%)	Required Total Facility Emission Rate (lbs/hr)	Required Total Facility 1-hour Average Emission Rate (lbs/mmbtu)
172.7	93%	7,960.2	0.43

Predicted exceedances of the 1-hour NAAQS for SO_2 based on allowable emissions extend throughout the region to a maximum distance of 50 kilometers.

Figure 1 shows the extent of NAAQS violations based on allowable emissions from the Ameren Labadie Plant.

Figure 2 shows the extent of NAAQS violations based on actual hourly emissions from all sources.

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[6] Allowable emissions are based on the 4.8 lbs/mmbtu limitation in Title V Permit to Operate No. OP2011-020 issued by

2.3 Conservative Modeling Assumptions

A dispersion modeling analysis requires the selection of numerous parameters which affect the predicted concentrations. For the enclosed analysis, several parameters were selected which under-predict facility impacts.

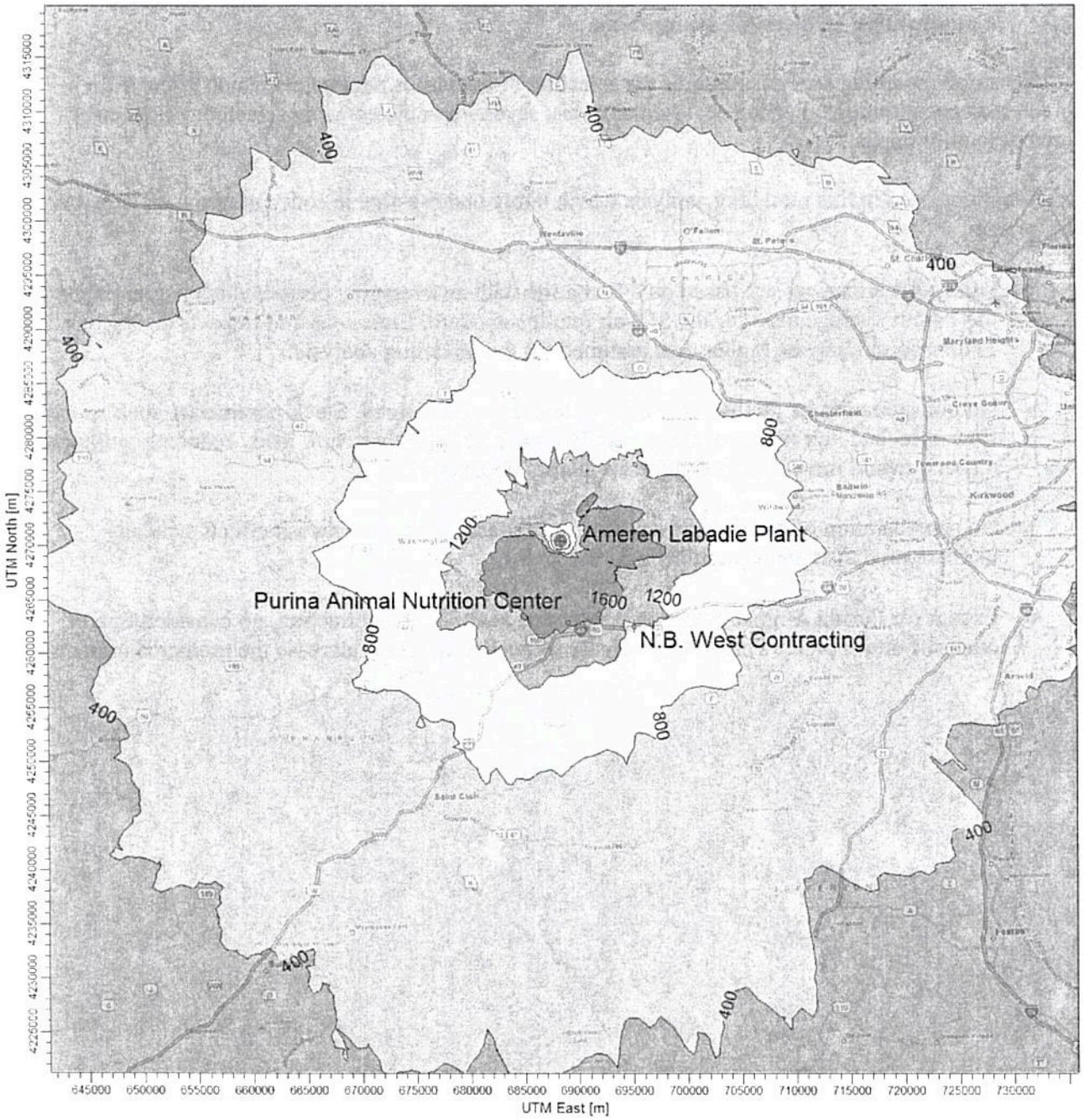
Assumptions used in this modeling analysis which likely under-estimate concentrations include the following:

- Allowable emissions are based on a limitation with an averaging period which is greater than the 1-hour average used for the SO_2 air quality standard. Emissions and impacts during any 1-hour period may be higher than assumed for the modeling analysis.

- No consideration of facility operation at less than 100% load. Stack parameters such as exit flow rate and temperature are typically lower at less than full load, reducing pollutant dispersion and increasing predicted air quality impacts.

- No consideration of building or structure downwash. These downwash effects typically increase predicted concentrations near the facility.

- Except for Purina Animal Nutrition Center and N.B. West Contracting, no consideration of other off-site sources. These other off-site sources of SO_2 will increase the predicted impacts.



1-hour SO2 Concentrations (ug per cubic meter) - All colored areas exceed the NAAQS.

196 400 800 1200 1600

Figure 1 - Regional View of Impacts Due to Allowable Emissions from Ameren Labadie Plant

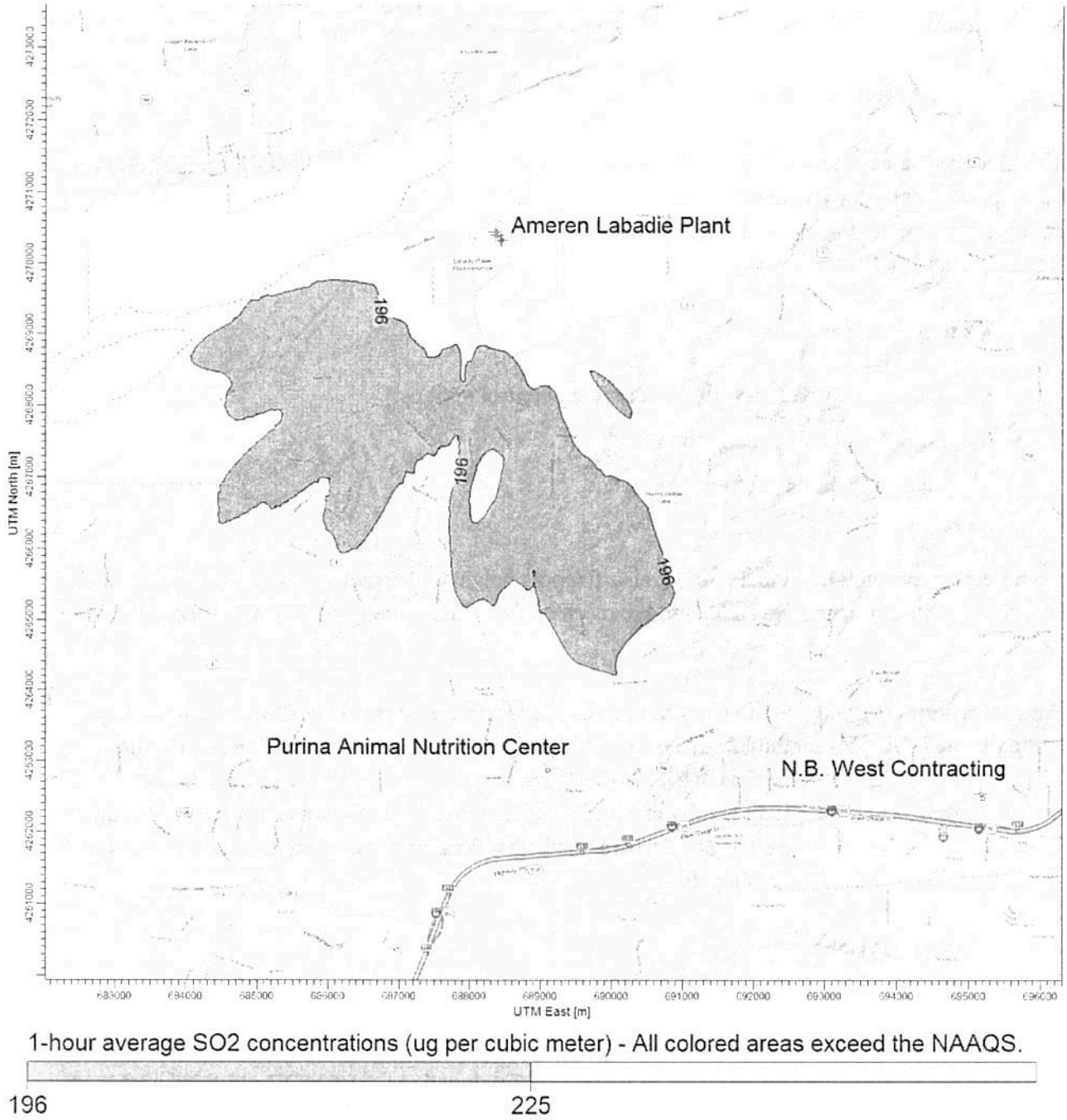


Figure 2 - Regional View of Impacts Due to Actual Emissions from All Sources

3. Modeling Methodology

3.1 Air Dispersion Model

The modeling analysis used USEPA's AERMOD program, v. 14134. AERMOD, as available from the Support Center for Regulatory Atmospheric Modeling (SCRAM) website, was used in conjunction with a third-party modeling software program, *AERMOD View*, sold by Lakes Environmental Software.

3.2 Control Options

The AERMOD model was run with the following control options:

- 1-hour average air concentrations
- Regulatory defaults
- Flagpole receptors

To reflect a representative inhalation level, a flagpole height of 1.5 meters was used for all modeled receptors. This parameter was added to the receptor file when running AERMAP, as described in Section 4.4.

An evaluation was conducted to determine if the modeled facility was located in a rural or urban setting using USEPA's methodology outlined in Section 7.2.3 of the Guideline on Air Quality Models.[7] For urban sources, the URBANOPT option is used in conjunction with the urban population from an appropriate nearby city and a default surface roughness of 1.0 meter. Methods described in Section 4.1 were used to determine whether rural or urban dispersion coefficients were appropriate for the modeling analysis.

3.3 Output Options

The AERMOD analysis was based on three years of recent meteorological data. The modeling analyses used one run with three years of sequential meteorological data from 2012-2014. Consistent with USEPA's Modeling Guidance for SO_2 NAAQS Designations, AERMOD provided a table of fourth-high 1-hour SO_2 impacts concentrations consistent with the form of the 1-hour SO_2 NAAQS.[8]

Please refer to Table 1 for the modeling results.

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[7] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005.
[8] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 24-26.

4. Model Inputs

4.1 Geographical Inputs

The "ground floor" of all air dispersion modeling analyses is establishing a coordinate system for identifying the geographical location of emission sources and receptors. These geographical locations are used to determine local characteristics (such as land use and elevation), and also to ascertain source to receptor distances and relationships.

The Universal Transverse Mercator (UTM) NAD83 coordinate system was used for identifying the easting (x) and northing (y) coordinates of the modeled sources and receptors. Stack locations were obtained from facility permits and prior modeling files provided by the state regulatory agency. The stack locations were then verified using aerial photographs.

The facility was evaluated to determine if it should be modeled using the rural or urban dispersion coefficient option in AERMOD. A Geographic Information System (GIS) was used to determine whether rural or urban dispersion coefficients apply to a site. Land use within a three-kilometer radius circle surrounding the facility was considered. USEPA guidance states that urban dispersion coefficients are used if more than 50% of the area within 3 kilometers has urban land uses. Otherwise, rural dispersion coefficients are appropriate.[9]

USEPA's AERSURFACE v. 13016 was used to develop the meteorological data for the modeling analysis. This model was also used to evaluate surrounding land use within 3 kilometers. Based on the output from the AERSURFACE, approximately 5.5% of surrounding land use around the modeled facility was of urban land use types including Type 21 – Low Intensity Residential, Type 22 – High Intensity Residential and Type 23 – Commercial / Industrial / Transportation.

This is less than the 50% value considered appropriate for the use of urban dispersion coefficients. Based on the AERSURFACE analysis, it was concluded that the rural option would be used for the modeling summarized in this report. Please refer to Section 4.5.3 for a discussion of the AERSURFACE analysis.

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[9] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005, Section 7.2.3.

4.2 Emission Rates and Source Parameters

The modeling analysis considered SO_2 emissions from the Labadie, and the other two facilities. Other off-site sources were not considered. Concentrations were predicted for the scenarios shown in Tables 1 and 2:

1) allowable emissions based on the current permit issued by the regulatory agency, and

2) actual hourly emissions measured at the Ameren Labadie Plant each hour between January 1, 2012 and December 31, 2014 as taken from USEPA *Air Markets Program Data*.[10] Actual emissions for Purina Animal Nutrition Center and N.B. West Contracting were reported to Missouri DNR for 2013.

Stack parameters and emissions used for the modeling analysis are summarized in Table 4.

The above stack parameters and emissions were obtained from regulatory agency documents and databases identified in Section 2.2. The analysis was conducted based on 100% operating load using maximum exhaust flow rates and temperatures. Operation at less than full capacity loads was not considered. This assumption tends to under-predict impacts since stack parameters such as exit flow rate and temperature are typically lower at less than full load, reducing pollutant dispersion and increasing predicted air quality impacts. Stack location, height and diameter were verified using aerial photographs, and flue gas flow rate and temperature were verified using combustion calculations.

[10] http://ampd.epa.gov/ampd/

Table 4 – Facility Stack Parameters and Emissions [11]

Facility	Labadie					N.B. West	
Stack	S01	S02	S03	S04	E01	EP5	NB2
Description	Boiler 1	Boiler 2	Boiler 3	Boiler 4	Generator	Dryer	Heater
X Coord. [m]	688352.17	688387.01	688435.47	688439.28	688439.28	695174.86	695174.86
Y Coord. [m]	4270445.59	4270400.4	4270332.33	4270327.43	4270327.43	4262540.03	4262540.03
Base Elevation [m]	149.66	149.66	149.66	149.66	149.66	159	159
Release Height [m]	213.36	213.36	213.36	213.36	9.14	7.62	2.74
Gas Exit Temperature [°K]	443.065	442.49	433.204	441.708	866.483	376.15	298.15
Gas Exit Velocity [m/s]	34.72	35.558	34.517	34.946	7.112	5.526	0.001
Inside Diameter [m]	6.248	6.248	6.248	6.248	0.305	0.914	0.244
Allowable Emission Rate [g/s]	3,739	3,739	3,693	3,693	-	-	-
Actual Emission Rate [g/s]	-	-	-	-	0.002308	0.0116	0.01759

Facility	Purina	N.B. West
Volume Source	EU_10	EP17
Description	Boiler	N.B. West Drag Slat Conveyor
X Coord. [m]	689107.65	695196.75
Y Coord. [m]	4262863.7	4262475.07
Base Elevation [m]	172	159
Release Height [m]	5	5
Side Length [m]	1.524	1.524
Building Height [m]	-	-
Initial Lateral Dimension [m]	1.16	1.16
Initial Vertical Dimension [m]	4.65	4.65
Actual Emission Rate [g/s]	0.0409	0.07385

[11] Stack parameters obtained from Missouri DNR modeling file: Ameren Missouri Labadie Facility Hourly Emissions File Run 12-14 20 km multi tier rec grid including Interactive sources.

4.3 Building Dimensions

This modeling analysis did not address the effects of downwash and this may under-predict impacts.

4.4 Receptors

For Ameren Labadie Plant, three receptor grids were employed:

1. A 100-meter Cartesian receptor grid centered on Ameren Labadie Plant and extending out 5 kilometers.
2. A 500-meter Cartesian receptor grid centered on Ameren Labadie Plant and extending out 10 kilometers.
3. A 1,000-meter Cartesian receptor grid centered on Ameren Labadie Plant and extending out 50 kilometers. 50 kilometers is the maximum distance accepted by USEPA for the use of the AERMOD dispersion model.[12]

A flagpole height of 1.5 meters was used for all these receptors.

Elevations from stacks and receptors were obtained from National Elevation Dataset (NED) GeoTiff data. GeoTiff is a binary file that includes data descriptors and geo-referencing information necessary for extracting terrain elevations. These elevations were extracted from 1 arc-second (30 meter) resolution NED files. The USEPA software program AERMAP v. 11103 is used for these tasks.

4.5 Meteorological Data

To improve the accuracy of the modeling analysis, recent meteorological data for the 2012-2014 period were prepared using the USEPA's program AERMET which creates the model-ready surface and profile data files required by AERMOD. Required data inputs to AERMET included surface meteorological measurements, twice-daily soundings of upper air measurements, and the micrometeorological parameters surface roughness, albedo, and Bowen ratio. One-minute ASOS data were available so USEPA methods were used to reduce calm and missing hours.[13] The USEPA software program AERMINUTE v. 14237 is used for these tasks.

This section discusses how the meteorological data was prepared for use in the 1-hour SO_2 NAAQS modeling analyses. The USEPA software program AERMET v. 14134 is used for these tasks.

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[12] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, Section A.1.(1), November 9, 2005.
[13] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, p. 19.

4.5.1 Surface Meteorology

Surface meteorology was obtained for Spirit of St. Louis Airport located near the Ameren Labadie Plant. Integrated Surface Hourly (ISH) data for the 2012-2014 period were obtained from the National Climatic Data Center (NCDC). The ISH surface data was processed through AERMET Stage 1, which performs data extraction and quality control checks.

4.5.2 Upper Air Data

Upper-air data are collected by a "weather balloon" that is released twice per day at selected locations. As the balloon is released, it rises through the atmosphere, and radios the data back to the surface. The measuring and transmitting device is known as either a radiosonde, or rawindsonde. Data collected and radioed back include: air pressure, height, temperature, dew point, wind speed, and wind direction. The upper air data were processed through AERMET Stage 1, which performs data extraction and quality control checks.

For Ameren Labadie Plant, the concurrent 2012-2014 upper air data from twice-daily radiosonde measurements obtained at the most representative location were used. This location was the Lincoln, Illinois measurement station. These data are in Forecast Systems Laboratory (FSL) format and were downloaded in ASCII text format from NOAA's FSL website.[14] All reporting levels were downloaded and processed with AERMET.

4.5.3 AERSURFACE

AERSURFACE is a program that extracts surface roughness, albedo, and daytime Bowen ratio for an area surrounding a given location. AERSURFACE uses land use and land cover (LULC) data in the U.S. Geological Survey's 1992 National Land Cover Dataset to extract the necessary micrometeorological data. LULC data was used for processing meteorological data sets used as input to AERMOD.

AERSURFACE v. 13016 was used to develop surface roughness, albedo, and daytime Bowen ratio values in a region surrounding the meteorological data collection site. AERSURFACE was used to develop surface roughness in a one kilometer radius surrounding the data collection site. Bowen ratio and albedo was developed for a 10 kilometer by 10 kilometer area centered on the meteorological data collection site. These micrometeorological data were processed for seasonal periods using 30-degree sectors. Seasonal moisture conditions were considered average with winter months having no continuous snow cover.

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[14] Available at: http://esrl.noaa.gov/raobs/

4.5.4 Data Review

Missing meteorological data were not filled as the data file met USEPA's 90% data completeness requirement.[15] The AERMOD output file shows there were 0.42% missing data.

To confirm the representativeness of the airport meteorological data, the surface characteristics of the airport data collection site and the modeled source location were compared. Since the Spirit of St. Louis Airport is located close to Ameren Labadie Plant, this meteorological data set was considered appropriate for this modeling analysis. [16] Additionally, this weather station provided high quality surface measurements for the most recent 3-year time, and had similar land use, surface characteristics, terrain features and climate.

5. Background SO_2 Concentrations

Background concentrations were determined consistent with USEPA's Modeling Guidance for SO_2 NAAQS Designations.[17, 18] To preserve the form of the 1-hour SO_2 standard, based on the 99th percentile of the annual distribution of daily maximum 1-hour concentrations averaged across the number of years modeled, the background fourth-highest daily maximum 1-hour SO_2 concentration was added to the modeled fourth-highest daily maximum 1-hour SO_2 concentration.[19] Background concentrations were based on the 2011-13 design value measured by the ambient monitors located in Missouri.[20]

6. Reporting

All files from the programs used for this modeling analysis are available to regulatory agencies. These include analyses prepared with AERSURFACE, AERMET, AERMAP, and AERMOD.

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[15] USEPA, Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-05, February 2000, Section 5.3.2, pp. 5-4 to 5-5.
[16] USEPA, AERMOD Implementation Guide, March 19, 2009, pp. 3-4.
[17] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 20-23.
[18] USEPA, SO_2 NAAQS Designations Modeling Technical Assistance Document, Dec. 2013, section 8.1, pp 27-28.
[19] USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010, p. 3.
[20] http://www.epa.gov/airtrends/values.html